

NATURE MAGAZINE

October, 1943

35 Cents

Vol. 36, No. 8



Pep Up Your Meetings

Motion pictures of Nature and the Outdoors will take you far and wide in the world of the wild.



Schools; Garden Clubs; Women's Clubs; Nature and Hiking Clubs; Boy and Girl Scout Troops; Church, Civic and Fraternal Organizations; Sportsman and Conservation Groups will be interested in these motion picture films. Thrilling, educational motion pictures help to boost attendance at meetings. They make meetings more interesting and help to promote some educational activities by increasing a knowledge of Nature and the outdoors; developing a consciousness of the need for practical conservation of our national resources and the protection of wildlife.

FILMING WILDLIFE REQUIRES TIME, PATIENCE AND ENDURANCE

For forty years William L. Finley has been shooting wildlife. But everything he has shot still lives, for it was shot with a motion picture camera. More than two hundred thousand feet of film now carry the record of his camera hunting.

The American Nature Association commissioned Dr. Finley to edit eighteen 400-foot reels of 16 millimeter motion picture film, drawing upon the best of his material. Thus 200,000 feet of 35 millimeter film are condensed into the equivalent of 18,000 feet of the best shots of all.

These interesting, entertaining and educational films are grouped as follows:

GROUP I: Specially adapted for school use and for juvenile audiences.

11. *Babes in the Woods*: The life of Nature's young in the wild.
12. *Wild Animal Pets*: A naturalist's dog into whose life came many strange animals.
13. *Renting Houses for Songs*: An intimate study of bird life.

GROUP II: A spectacular series of Alaskan reels.

21. *Cruising North*: Murres, sea puffins, bear and other coastal wildlife.

22. *Off to Glacier Bay*: Spectacular pictures of the face of a glacier breaking off and plunging into the bay. Also wildlife scenes.
23. *Wild Animal Outposts*: Hardy Island deer, ptarmigan, bear cubs, blue fox, fur seals of the Pribilofs.
24. *Thar She Blows*: Whales at sea.
25. *Great Bear of Alaska*: Films of the great Kodiak bears of Admiralty Island.

GROUP III: Southwestern series.

31. *Wings to the South*: Bird life of the Texas Gulf coast and the southwest.
32. *Riding the Rimrock*: Searching the rough country of the southwest for its wildlife.
33. *Nature's Side Show*: The struggle for existence in the arid southwest.
34. *Queer Creatures of the Cactus Country*: A study in the adaptation of wildlife to a harsh land.
35. *Getting Personal with Mountain Lions*: A thrilling picture of a pack trip into lion country.

GROUP IV: Photographed along the Continental Divide.

41. *The Big Game Parade*: You meet Antelope, Mountain Sheep, Mule Deer, Elk, Bison, Moose, Brown Bears and Grizzlies.
42. *The Forests*: Forest Fires, Birds, Beaver—greatest conservationist of all—at work.
43. *When Mountains Call*: The life of the high places is thrilling to see. Water Ouzel, Ptarmigan, American Eagle, Big Horn Sheep, Wapiti—American cousin of the European Stag.
44. *Ramparts of the North*: Filming big game requires endurance. Glaciers, Hoary Marmot, Caribou, Moose, Black Bear.
45. *Getting Our Goat*: Mountain Goat on its native crags. Ground Squirrels, Cony, Grouse.

AVAILABLE AT A NOMINAL RENTAL

The Association will pay expressage or postage when films are shipped to customers. The customer will pay return mailing charges and will be responsible for films until returned to 1214 Sixteenth Street, N.W., Washington, D. C. Rentals will be shipped C. O. D. unless paid for in advance.

Films are to be shipped back the day after showing. No extra charge for time consumed in transit.

When reservations are made, customers are urged to select 1 or 2 alternate choices.

RENTAL RATE

Group I—3 reels	\$3.00
Groups II, III and IV—Each 5 reels	\$5.00
Single Reels or any multiple of those available—each reel	\$1.00

MAIL YOUR ORDER FOR FILMS
OR WRITE FOR
ADDITIONAL INFORMATION

to

Film Department
American Nature Association
1214 Sixteenth St., N.W.,
Washington, D. C.





Mister—you're getting paid in DYNAMITE!

LET'S NOT KID OURSELVES about this. Our pay envelope today *is* dynamite.

If we handle it *wrong*, it can blow up in our face . . . lengthen the war . . . and maybe wreck *our* chances of having happiness and security *after* the war.

The wrong way to handle it . . . and why

The wrong way is for us to be good-time Charlies. To wink at prices that look too steep . . . telling ourselves we can afford to splurge.

We *can't* afford to—whether we're business men, farmers, or workers. And here's why:

Splurging will boost prices. First on one thing, then all along the line.

Then, wages will have to go up to meet higher prices. And higher wages will push prices up some more . . . faster and faster, like a runaway snowball.

The reason this can happen is that there is more money in pay envelopes today than there are things to buy with it. This year, we Americans will have *45 billion* dollars more income than there are goods and services to buy at present prices. *45 billion dollars extra money!*

That's the dynamite!

The right way to handle it . . . and why
Our Government is doing a lot of things to

keep the cost of living from snow-balling.

Rationing helps. Price ceilings help. Wage-and-rent stabilization helps. Higher taxes help. They're *controls* on those dangerous excess dollars.

But the real control is in our hands. Yours. Mine.

It won't be fun. It will mean sacrifice and penny-pinching. But it's the only way we can win this war . . . pay for it . . . and keep America a going nation afterwards.

And, after all, the sacrifice of tightening our belts and doing without is a small sacrifice compared with giving your life or your blood in battle!

Here's what You must do

Buy only what you absolutely need. And this means absolutely. If you're tempted, think what a front-line soldier finds he can get along without.

Don't ask higher prices—for your own labor, your own services, or goods you sell.

Resist pressure to force **YOUR** prices up.

Buy rationed goods only by exchanging stamps. Shun the Black Market as you would the plague.

Don't pay a cent above ceiling prices.

Take a grin-and-bear-it attitude on taxes. They must get heavier. But remember, these taxes help pay for Victory.

Pay off your debts. Don't make new ones. Getting yourself in the clear helps keep your Country in the clear.

Start a savings account. Buy and keep up adequate life insurance. This puts your dollars where they'll do you good.

Buy more War Bonds. Not just a "percent" that lets you feel patriotic, but enough so it *really* pinches your pocket-book.

If we do these things, we and our Government won't have to fight a post-war battle against collapsing prices and paralyzed business. It's *our* pay envelope. It's up to *us*.

KEEP PRICES DOWN!

Use it up • Wear it out

Make it do • Or do without

This advertisement, prepared by the War Advertising Council, is contributed by this Magazine in co-operation with the Magazine Publishers of America.

IRISH SETTER. Taken with exposure of 1/100th of a second at f/11, with medium yellow filter, on Super XX film in a Super Ikonta B camera. Negative developed in Harvey 777 Panthermic.



Camera Trails

By NORRIS W. HARKNESS

Some October Thoughts

Usually when October rolls around with its irresistible color we cannot resist the temptation to talk about Kodachrome and color photography, but this year color film is scarce in many places and except for one note, we will go to something else. It becomes more and more certain that we shall have direct color printing processes soon after victory—processes that will enable you to make full color prints in your own darkroom almost as easily as you now make black and white enlargements. To be ready for them and have a permanent color record of what is happening now, do not neglect Kodachrome and, even more important, Kodacolor. Although you may do nothing more than store the films away until color paper arrives, you will be glad to have them when we finally do get it. Right now we have some 350 Kodacolor negatives that we expect to print proudly some day.

We want to answer as fully as we can a question that came in the mail a few days ago. The letter was from Larry Evans of Lexington, Kentucky, and says: "I am fourteen and some day I'm going to be a good photographer. Right now I want to know two things. (There are a lot of others, but these two bother me most.) How do the professionals who make the pictures for the advertisements get the quality, I guess you'd call it, in their prints, and how do they go about making shots that fit the season so well? I know the pictures are made far ahead to give time for the printing of the magazines, but how is it done?"

That feeling, "I'm going to be a good photographer," is one reason the professionals make good pictures, Larry, as you will. A good professional photographer is doing more than make photographs for a living; he is making pictures for the joy of making the very best he can and he is never satisfied until he is perfectly satisfied that he can do no better. But he is still sure that by this time next year he will be able to do better—and next year, and the year

after, he does.

Their fine quality comes from careful attention to every detail in the process. First they decide on just what they want, perhaps with the help of the agency who ordered the picture. They pose the shot as it should be posed, and then plan the lighting. If it is to be out of doors, they never work on dull days, unless that flat effect is what is desired, and on sunny days they use reflectors to balance highlights and shadows and avoid those unpleasant black shadows that come from too much contrast in the lighting plan.

Then notice that almost every picture you see uses side lighting and a good, full exposure that shows everything. If there are to be clouds, a filter brings them out. The development and printing are done in that same careful, thoughtful fashion and nothing is left in the "good enough" class. It must be the best possible or nothing. That's how they get that quality—and that's how you can and will get it too.

As for their timing, advertising agencies and magazine editors often work a year or even two years ahead. The harvest scene you saw on that magazine last week may have been photographed last fall by order of the editor, who saw one that pleased him and got the idea for his October, 1943, cover. Many times they are studio shots with the settings elaborately arranged and painted, or perhaps put in by accurate double printing of the central subject in a scene that had been photographed before. Many tricks are possible for the really skillful craftsman—tricks in all trades—and the camera can lie quite well.

Following the Dogs

Last week we accompanied two dog trainers who are readying their setters for field trials later in the year. We missed two beautiful chances for flying bird because they unexpectedly burst into flight, but the dog shots worked out well. We did one or two of the almost stereotyped full-figure shots with the dog on point, tail rigid and each hair flying eagerly, but most of them were action pictures of the dogs either running or jumping.

For these rather fast action shots we used a shutter speed of 1/200th second with the fastest film and medium yellow filter to hold the clouds. That shutter speed would not have been fast enough to stop the movement at short range, but most of the exposures were made at fifteen feet or more—we could rarely

get closer than that—so that speed was enough.

The best pictures were of the dogs either crossing the line of the camera or coming toward us, but all we really had to do was to pick the moment for the best pose. They make pictures all the time.

In trying these shots by all means get the dog on point, but include if you can his master and the rising of the bird. Nothing else gives the picture as thrilling excitement, and the pose is, of course, superb, even though it has been done so often. Most shutters will need their fastest speed, with fast film like Super XX, to get the maximum depth of field through a reasonably small aperture. On a bright sunny day 1/200th second will work all right at f/8 with that film, even with the medium yellow filter. But watch for the angle of the light. If it hits the dog from the side, or even a little on the side away from the camera, you will have the best effect.

Those pictures are simplest if you just go along for a while and find out what to expect and when it may happen. Shooting at the start is almost sure to make you waste valuable film and miss better chances later. Be set for anything and then shoot it.

The Question Corner

N.E.H., Quebec, Canada, asks: "What can I do to make up for the fact that my dealer has no normal paper and says he cannot get it? Most of my negatives use the #2 grade and I can get neither #2 nor #3."

ANS.—The solution to the dilemma in my case has been Varigam, the Defender paper that works in all contrasts by utilizing various filters on the enlarger lens in the printing. Varigam is available in several surfaces and the set of five gelatine filters costs only a dollar. Through the softest filter, #1, the paper's contrast is softer than the soft grade of Velour Black, and the #10 filter makes it harder than anything but the Extra Hard grade. With no filter, Varigam has a normal contrast.

Thus with one package of paper you are ready to match the contrast of almost any printable negative, and with the double set of ten filters, you have the equivalent of ten different grades of paper. The only difference Varigam requires in your regular darkroom technique is the red safelight instead of the yellow-green one, and, of course, the filter on the enlarger lens.

W.L.D., Farmington, Connecticut, writes: "Most of my negatives have a light area in all four corners that looks almost as though there had been something near the camera covering them. It is the same camera that I have used for three years without trouble. What might be the cause?"

ANS.—Probably your lenshood, if it is a new one, has too narrow an angle and is cutting off the corners. It may be that you are placing it too far out on the lens barrel, thus giving the same effect. If there is nothing loose inside the camera, there is nothing else that is likely to give such trouble.

T.McM., Columbia, Georgia, asks: "What can I do to fix up a roll of film that was unintentionally developed only about half the normal time?"

ANS.—If those negatives were exposed normally and the only trouble is the lack of sufficient development—a fact you can check by the amount of detail in the shadows—the best cure is intensification. If they are to be enlarged greatly, there is danger of grain with any type of intensification, but my suggestion is Victor Intensifier, which your dealer can supply. The tube is dissolved and makes a yellowish liquid in which the film is placed for anything from a few seconds to five minutes. I put the film back into the developing tank and keep the agitation going throughout the time to avoid any danger of streaks, and it works well for me. The solution can be used several times but requires more time after the first use.

G.T., Denver, Colorado, asks: "Why do you recommend panchromatic films when the orthos like Verichrome work so well?"

ANS.—I have never said the orthochromatic films were not excellent, but I do prefer the pan emulsions because of their slightly more accurate color tone reproduction, but principally because they have smaller filter factors and are steadier in sunset light. The comparative blindness of the orthos to red light makes the filter factors higher with the medium yellow and orange I use most for natural and emphasized skies, and, since the light late in the day is quite strong in red, the orthos sometimes require too much increase in exposure. It is a matter of preference, but right now there is Verichrome in the camera.



MOTHER OF 4 EARNS \$1,000 ON HER WRITING

"Without jeopardizing our home life a bit, I have been able to earn \$1,000 since graduating from N. I. A. If I had not the responsibility of four small children, home duties, haphazard health and war work, I am sure I could have made much more. After only two lessons I sold a garden series to Baltimore American. The N. I. A. way makes writing child's play."

—Gladys Carr, Annapolis, Md.

How do you know you can't write?

Have you ever tried?

Have you ever attempted even the least bit of training, under competent guidance?

Or have you been sitting back, as it is so easy to do, waiting for the day to come when you will awaken all of a sudden to the discovery, "I am a writer"?

If the latter course is the one of your choosing, you probably *never will write*. Lawyers must be law clerks. Doctors must be internes. Engineers must be draftsmen. We all know that, in our times, the egg does come before the chicken.

It is seldom that anyone becomes a writer until he (or she) has been writing for some time. That is why so many authors and writers spring up out of the newspaper business. The day-to-day necessity of writing—of gathering material about which to write—develops their talent, their insight, their background and their confidence as nothing else could.

That is why the Newspaper Institute of America bases its writing instruction on journalism—continuous writing—the training that has produced so many successful authors.

Learn to write by writing

NEWSPAPER Institute training is based on the New York Copy Desk Method. It starts and keeps you writing in your own home, on your own time. Week by week you receive actual assignments, just as if you were right at work on a great metropolitan daily. Your writing is *individually* corrected and constructively criticized. Thoroughly experienced, practical, active writers are responsible for this instruction. Under such sympathetic guidance, you will find that (instead of vainly trying to copy someone else's writing tricks) you are rapidly developing your own distinctive, self-flavored style—undergoing an experience that has a thrill to it and which at the same time develops in you the power to make your feelings articulate.

Many people who should be writing become awestruck by fabulous stories about millionaire authors. Therefore they give little thought to the \$25, \$50 and \$100 or more that can often be earned for material that takes little time to write—stories, articles on business, hobbies, travels, sports, news items, human interest stories, civilian defense activities, war work, etc.—things that can easily be turned out in leisure hours, and often on the impulse of the moment.

A chance to test yourself

Our unique Writing Aptitude Test tells whether you possess the fundamental qualities necessary to successful writing—acute observation, dramatic instinct, creative imagination, etc. You'll enjoy taking this test. The coupon will bring it, without obligation. Newspaper Institute of America, One Park Avenue, New York 16, N. Y. (Founded 1925)

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Newspaper Institute of America's operations in Canada have been approved by the Foreign Exchange Control Board, and to facilitate all financial transactions, a special permit has been assigned to their account with The Canadian Bank of Commerce, Montreal.

Free

Newspaper Institute of America
One Park Avenue,
New York 16, N. Y.

Send me, without cost or obligation, your free Writing Aptitude Test and further information on writing for profit as promised in Nature Magazine, October.

Mr. _____
Mrs. _____
Miss _____
Address _____
(All correspondence confidential. No salesman will call on you.) 87-M-693

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NATURE MAGAZINE

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To Stimulate Public Interest in Every Phase of Nature and the Out-Of-Doors, and
Devoted to the Practical Conservation of the Great National Resources of America

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A. B. McClanahan, Advertising Manager

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Los Angeles—Western Pacific Building
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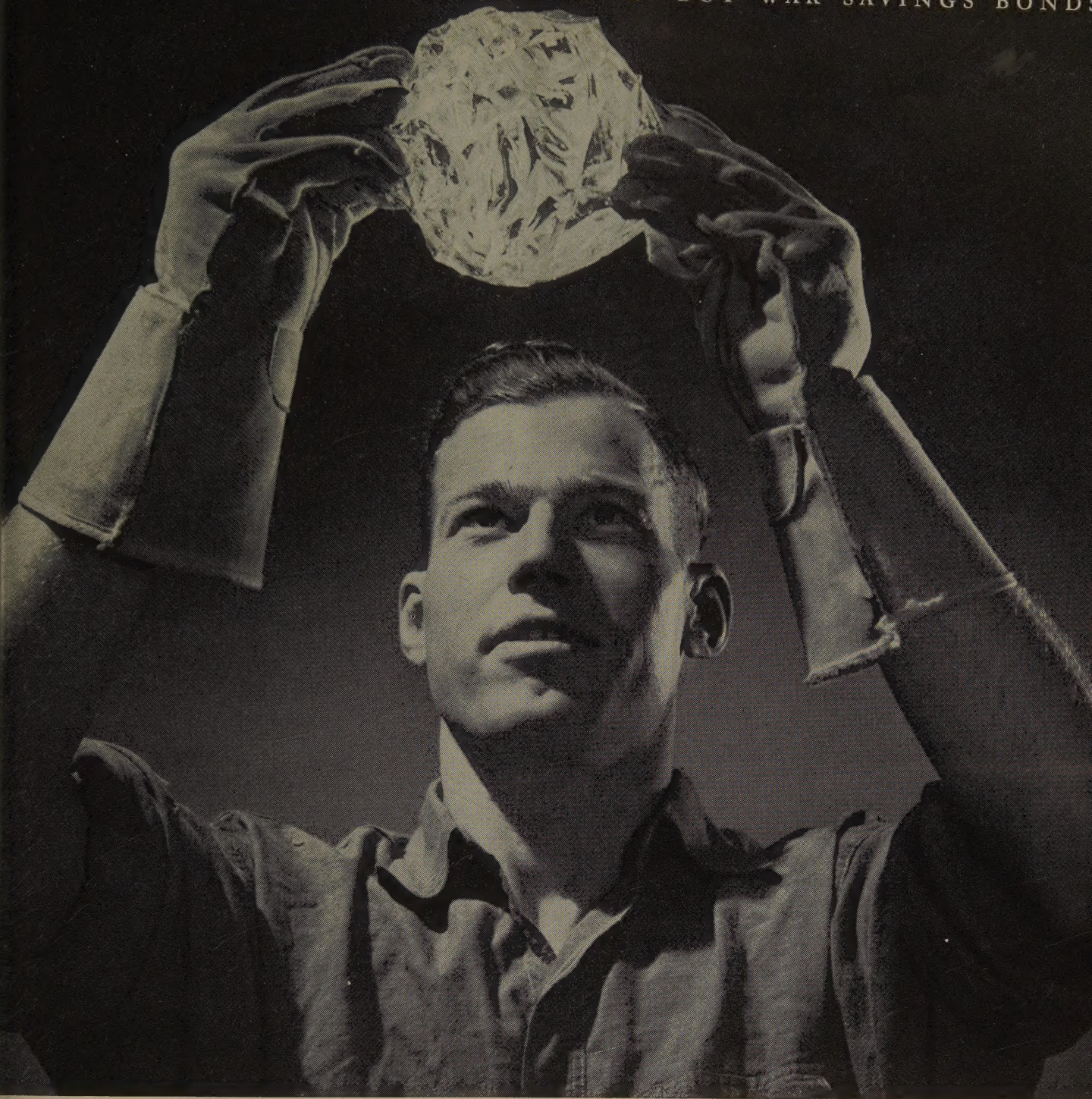
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This is an "Optical" War



Pete Miller, glass inspector, is pleased with that chunk of precious optical glass. He knows this is an optical war. He knows that accurate gun-fire control depends upon optical glass . . . flawless and crystal-clear.

But Pete Miller is not thinking of his skill as a glassmaker at Bausch & Lomb. In that glass he sees his friends at gun-fire-control stations on battle cruisers, in the turrets of tanks roaring down on an enemy position, or making aerial photographs behind enemy lines. And always he sees them peering into the sights of a Bausch & Lomb optical instrument.

The glass Pete Miller holds was made to a special formula. It will be ground and polished to become part of the prisms for an Anti-Aircraft height finder. As fighting Americans dial this instrument into focus, guns automatically will be brought to bear on enemy planes with deadly accuracy.

Yet this is but one of dozens of types of Bausch & Lomb glass, made to meet exacting optical specifications. Bausch & Lomb glass is also required in the optical systems of binoculars, range finders, microscopes, colorimeters, refractometers, metallographic and spectrographic equipment and scores of other products.

The Bausch & Lomb optical glass plant was born fighting—developed at head-long speed during World War I to make this country forever free from foreign sources. Operated by men like Miller, guided by researchers and technicians, this plant today makes possible the amazing effectiveness of thousands of scientific instruments.

BAUSCH & LOMB
OPTICAL CO. ROCHESTER, N. Y.

ESTABLISHED 1853



**Joe needs
the Long Distance
lines tonight**

He has a promotion to report. Or a week-end leave coming up. Or it's his mother's birthday.

Evening is about the only time he's free to call and it's important to him.

Will you do your best to avoid Long Distance calls after 7 at night, for the sake of millions of Joes — and Josephines? They'll appreciate it.

BELL TELEPHONE SYSTEM



Contents Noted

Addressing the members of the Save-the-Redwoods League, their president, Dr. John C. Merriam, suggested that the makers of the next peace make "a sojourn of at least a few hours in a redwood temple, where time must be faced and in some measure appreciated." We have always wondered why peace must be negotiated where man can strut and pose against the background of mirrored palaces and marble corridors. The results of his peace-making seem as transitory as his puny image in the shining surfaces against which he pontificates. We would go farther than Dr. Merriam. Let the peace conferees gather about rough tables and sit on rough benches in a redwood grove. Surely becoming humility and humanity would seep into their beings in the cathedral beauty created by trees that first sought the light when Christ trod our earth.

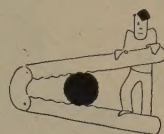


We had no idea that hunting woodchucks was such a perilous and complicated affair. However, the Pennsylvania Game Commission solemnly warned woodchuck hunters "to be extremely careful so as not to be mistaken for one of the creatures and be accidentally killed or injured, or to mistake another hunter for one of the animals." Intrepid nimrods engaged in this dangerous activity are advised to wear "plenty of red, orange or even white clothing." Also they should not lie down in high grass with the head bared, unless, we suppose, they are bald. In that case they might be mistaken for a melon, which is probably dangerous, too. Finally they are adjured to hide from the wily groundhog in a place "that will not invite a load of shot from someone who fires at the slightest movement." On the opening day of the season, a farm boy with light brown hair lay watching a woodchuck hole and was shot through the head by a neighbor boy. This is a tragic result of what, to our mind, is a pretty silly business anyway.



John W. Hershey is the Johnny Appleseed of the nut world, and we are not using nut in the adjectival and vernacular sense. Secretary of the Pennsylvania Nut Growers Association, he has been preaching the importance of planting nut trees for shade, beauty and crop for a quarter century. Right now he is spon-

soring an American black walnut contest to develop better black walnuts. Our scouts report that the shell of this nut already has some thirty commercial uses. The kernel has food and great potential oil values. The hull serves also. Anyone interested in "improving the breed" of black walnuts should send ten cents to John W. Hershey, Dowington, Pennsylvania, for details. The dime is necessary because his nut missionary work keeps him broke, and his Association has no spare fund for postage and printing in this program.



Cruising in a scout car, a Buffalo, New York, police lieutenant spotted a beaver—of all things—on a city street. He gave chase, and the report says that the animal, overtaken, just curled up and waited the worst from the hands of the law. It turned out to be feet, for the copper tried to roll the beaver over. Whereupon the beaver, not unnaturally, bit right through the official brogan and into a large, large toe. Which indignity brought the end to *Castor* with the crash of a .38-calibre bullet. Why the animal was wandering around on inhospitable asphalt seems a mystery. It will certainly be a lesson to the beaver, and we hope that the next time the lieutenant will leave stray wildlife to the folks at the excellent Buffalo Museum of Science, where they know how to meet such emergencies. It appears that those who know Nature have a tremendous task of education, for the average city dweller's first impulse is to kill that which he does not understand.



Thirty thousand additional nurses are needed for the Army and Navy Nurse Corps during the next twelve months. The need is dire, and the American Red Cross, official recruiting agency for the Corps, issues an appeal for women qualified for this tough and sacrificing work. Ours is a conservation publication, and we share with all Americans great concern for the conservation of the lives of our men who are offering them for humanity. And it is the nurse who has a great share in this conservation. We have only to look at the story of the immortal heroines of Bataan to see the stuff of which American nurses are made. Yet 2500 more are needed each month to join those now serving in more than five hundred stations in thirty-five countries outside the United States, and in military hospitals at home.

R. W. W.



"It is not uncommon to see two males feeding the same brood of fledglings, with no disputes about the question of fatherhood . . ."

Wild guiles and ingenuities, instinctive
cunnings and prankish glee make the crow—

A Genius in Feathers

Illustrated by Else Bostelmann

By ALAN DEVOE

HENRY WARD BEECHER once said that if human beings wore wings and feathers, very few of them would be clever enough to be crows. He might have added that few would be humorous, mischievous, or unpredictable enough. The common crow, *Corvus brachyrhynchos*, whether in the wild state or kept as a pet, is a genius in feathers and an endlessly astonishing bird.

There was the one owned by a lady in Stuart, Ohio, that was so dainty that he insisted on washing worms before he would eat them. There was the Staten Island crow that not only could pick pockets, but, when he found a pocket empty, would cry "Go to hell!" and fly away in a huff.

To be sure, not all crows can talk. Their individual ability varies greatly in this respect, and probably no crow can talk better if its tongue is split; but certain ones taken young have been known to learn a hundred words, and half as many complete phrases, and there are even records of wild crows picking up and raucously using such human expressions as "Giddyap!" and "Whoa!" and "Hey!" which they hear farmers shout in the fields.

When a crow does speak human language, he often gives the impression that he knows the exact meaning of what he is saying. A moonshiner, who had kept a pet crow as a lookout against revenueurs, was taken to the jail in Harris County, Georgia. The crow was taken too. The human prisoner gave no trouble, but the bird proved something of a problem. He yelled, "I want water!" when the supply in the cell began to dwindle, and whenever an attractive female visitor passed through the jail corridor he craned his neck between the cell bars, ogled the lady and muttered ribaldly, "Oh-boy-oh-boy-oh-BOY!"

The common crow, with his three closely related varieties, the Florida crow, southern crow and western crow, is found practically all over our country east of the

Rocky Mountains, as well as sections in the Northwest and along our western coast down to southern California.

In building their nests, as in everything else, crows prove that they are individualists. Most often the nest, a bulky structure of coarse sticks, twigs, grasses and tree bark, lined with soft rootlets or fur or moss, is in an evergreen, and is about 30 feet from the ground. In rare instances it may be on the ground. They often decorate a nest by inserting in it a shiny pebble or glittering piece of glass.

As a rule there are four or five eggs, pale bluish-green, mottled with brown and black. I once watched the nesting-history of a crow family whose brood consisted of just one egg. In Wolfville, Nova Scotia, an astonished ornithologist found a nest loaded with ten eggs.

As crows are always more or less clannish, there are usually a number of nests within a small area, and the occupants exercise their sly mischievousness by incessantly stealing each others' nesting materials.



"... the occupants exercise their sly mischievousness by incessantly stealing each others' nesting material."

When one of the nesters flies off to feed for a while, one of his dark neighbors rushes to the unprotected abode, adroitly removes from it the choicest bits of moss and rootlets, and secretes them in his own nest. Then, when the thief is absent from his nest for a while, the recently burglarized bird flies over and regains all the stolen goods, plus half a dozen other choice bits. This pilfering is probably a friendly joke, for actually crows are devoted to one another and are bound by a sense of unity that leads them to show each other extraordinary courtesy and understanding.

I have often watched how, when an injured crow emits caws of distress, his fellows rush to him from the surrounding countryside, lament over him as though agonized by his misfortune, and try to feed him restoratives. Edward Howe Forbush, the famous ornithologist, tells a story of a crippled crow that fell into the Merrimac River off Newburyport, cawed desperately for help, and was rescued by fellow flock-members who worked in relays to keep him afloat and gradually to drag him ashore.

Being individualistic and unconventional, crows in the nesting season frequently become involved in sex mix-ups, and the eternal triangle is common among them. When this happens, fights rarely result; the trio settles down to an unorthodox design for living. It is not uncommon to see two males feeding the same brood of fledglings, with no disputes about the question of fatherhood, and I have seen two females alternately brooding a nestful of eggs while accepting the attentions of one strutting male who was their mutual husband.

Before crow babies hatch, mother and father usually go through a rehearsal of coming events. The female in the nest flutters her wings, coos, and pretends to be a baby; the male brings her tidbits and sings to her a peculiar, low sweet song. In a triangle situation involving two males, both perch on the nest-rim and sing a harmonious cradle-song duet.

"A pet crow belonging to a Long Island naturalist once consumed a pint of house paint and survived."



The young stay in the nest about three weeks, consuming their weight in food every day, and by the time they are ready to leave they look almost like their parents except that their coats have less luster. For several days they practice flight maneuvers and wing drills before the critical elders of the flock. The oldsters show them the lay of the land and teach them the rules of the community of fifty or sixty crows nesting in the neighborhood.

Despite the individualism of its members, a flock is as disciplined as an army. It posts sentinels in a high tree to keep watch while the others feed. It has special flight maneuvers: low, fast and scattering for the mornings; high, slow and single-file for the evenings; forty-five miles per hour in absolute silence when the sentry signals that a man with a gun is coming. When traditional enemies such as owls or foxes are sighted, it is a rule that all flock-members must raise a terrific rumpus. Only when the young have been rigorously trained in these observances are they ready for adulthood.

The youngsters take advantage of their long apprenticeship to swindle as much free food as possible out of their parents. Although perfectly able by now to forage for themselves, they pester their elders with loud and piteous petitionings to be fed. Sometimes the wiler of the young apparently feign illness in order to sponge on their parents. Crows begin to be geniuses at an early age.

Life for crows, as for all other creatures, consists principally of getting enough to eat and coping with enemies. Getting food affords an uproarious exercise, a never-ending antical game of sly jokes and preposterous stratagems.

Crows can and do eat almost anything: a wasp, a toad, or even poison ivy. They eat so many other things that a list of them takes three pages of fine type in a Department of Agriculture report. Certain items are special favorites, and crows' inventions for getting them are endless.

Hunting for mice, for instance, is tedious, so a crow sometimes rides on the back of a pig that is foraging in the field; when the rooting porker turns up a field mouse the wily bird gobbles the mouse and flaps off with a mirthful cackle. To get shellfish, which he loves but which his beak is not strong enough to open, a crow picks up a clam or oyster, flies high in the air, and drops the bivalve on a rock.

If a crow spies a fox carrying prey, he sets up a tumult that fetches all his brethren in the neighborhood; they then swoop down and pester the fox until he gives up his prize. Crows seek out a watermelon patch, puncture the rinds, and drink their fill of the sweet juice.

All crows have the gift of mimicry, but certain outstanding geniuses among them

"An expert mimic and singer performs his repertory while the others of the flock perch in a rough circle around him and caw their applause."

have so perfected the art that they can imitate the squawk of a hen, the whine of a dog, or the crow of a rooster. I have watched a crow, artfully concealed in a chicken yard, clucking and cackling and crowing to lure a hen from her chicks. When this failed, the crow strolled forth from concealment and walked maddeningly up and down in front of the hen until she made a rush at him, whereupon he skipped deftly aside, cawed stridently twice, and summoned two hidden crow-cronies who darted down and seized two of the chicks.

There is no limit to the hunting tricks of *Corvus*, and very little limit to his appetite and digestion. A pet crow belonging to a Long Island naturalist once consumed a pint of house paint and survived.

Aside from man, crows have few dangerous enemies. An owl sometimes raids a crow roost at night and kills a sleeping bird. Whenever crows locate an owl in daylight they mob him and thrash him to the accompaniment of a hubbub of foul imprecations. They gang up similarly on hawks, raccoons, skunks, cats and any other creatures that they know might harm their eggs or young.

Of humans, the wise and wily bird can afford to be almost contemptuous. Sentinels can spot a gun-barrel half a mile away, and never confuse it with a fish-pole or a walking-stick.

Crows have a vocabulary, some naturalists believe (and I am one of them), of at least twenty-five caw-words for keeping each other posted on doings in the neighborhood. All crows can hear so well that they detect the snap of a twig in the woods more acutely than any other wild creature except a deer. State and local governments have offered bounties on crows for years, but ornithologists wryly agree that there are more crows in the country today than there were when the Pilgrims landed.

Without serious threat from enemies or starvation,



crows are free to spend much of their time in games and practical jokes. One favorite and rowdy game is Waking The Sleepers. On hot noondays they love to fly silently over the countryside, sneaking up on a slumbering rabbit and rapping him sharply on the skull or settling silently on the backs of drowsy cattle and then setting up a sudden uproar that terrifies the cows.

Another sport is Hide and Seek. A young crow leaves the flock unobtrusively, hides in a hollow tree, and loudly sounds the distress caw. The flock rushes to the spot, fails to find him, and flaps away again. The distress caw is again sounded. Back comes the flock, hunts vainly again, and again goes away. This may be repeated a dozen times, after which the young crow pops out of concealment and guffaws. The flock, far from being annoyed, bursts into a hawing and cawing of general merriment.

Crows amuse themselves by roaming the countryside looking for white pebbles, shells and similar bright objects, which they hide in caches to gloat over, and which they also use in their crowish version of a ball game. I watched this game last summer in a birch wood, which provided a perfect grandstand seat.

Arlington National Cemetery has housed 150,000 crows; another at Peru, Nebraska, contained 100,000. These great roosts are used for centuries; records show that some of them have been occupied by wintering crows since the white man first arrived in this country.

The crow's cycle of life lasts (unless a shotgun interferes) for about twenty-five years. Except for guns or poison, almost the only thing that kills a

crow is roup, a disease that causes inflammation of the mucous membranes, and blindness.

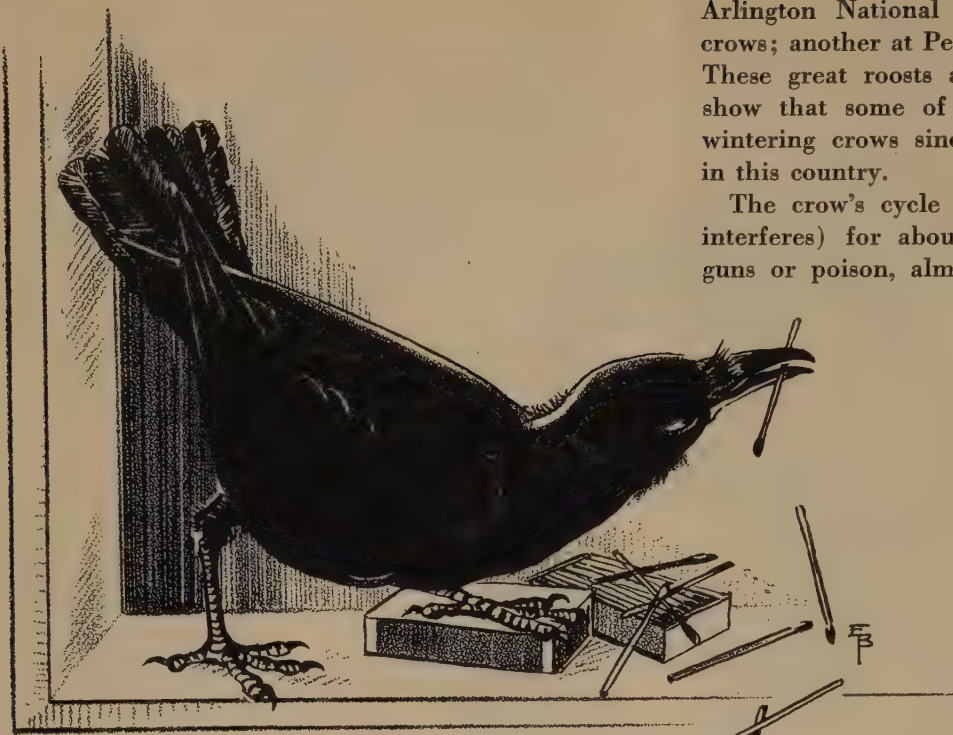
Crows' influence on agriculture is about evenly divided between harm and good. About seventy-two percent of a crow's diet is of vegetables, fruits and nuts, about half the vegetable category being corn. The remaining twenty-eight per cent is of insects, rodents, and a few odds and ends such as eggs and fledglings of wild birds, poultry chicks, carrion, and reptiles.

If a tar or red lead repellent is used on seed-corn, crows leave it alone, and their rodent and insect diet makes them an asset on the farm. Sometimes, however, the crows come trooping back to the same cornfield when the ears are ripening, and peck small holes in the husks. They do not eat much of the corn, but rain water gets in and rots the ears.

Many are the tales told of the amazing doings of pet crows. One owned by William Crowder, the well-known naturalist, developed the perilous habit of playing with kitchen matches. Having to be away from home and not wanting the house burned down in his absence, Crowder hid the kitchen matches and left a box of safety matches in their place. On his return he found his pet throwing the safety matches out of the window one by one, and, as he hurled them he leered at Crowder and cried, "Ha! Ha!"

An eminent crow named Pete that lived in the South in the 1830's was one of the most famous characters that the Bluegrass Country ever produced. Pete was responsible for the introduction of starting bells at race tracks. He was in the habit of frequenting the Georgetown race track, and on the day of a big race, just as the horses were being lined up, Pete created pandemonium by yelling, "Go!"

The knowingness of a crow is not the thought-born "intelligence" of a man. It is a thing of wild guiles and natural ingenuities, instinctive cunning and an innate prankish glee. Its unexpected workings make its dusky possessor a perpetual entertainment and the source of constant surprise to all who observe.



"On his return he found his pet throwing the safety matches out of the window one by one, and as he hurled them he leered at Crowder and cried, 'Ha! Ha!'"

There were seven crows playing. One, holding a white snail shell in his beak, would launch out from one of the small birch trees. The other six would fly after him, swooping down on him and buffeting the shell-bearer to make him drop his prize. When he did, the fallen shell would be snatched from the ground by another of the players, who would then launch forth, only to be set upon by his playmates in a repetition of the earlier performance.

Crows often stage concerts. An expert mimic and singer performs his repertory while the others of the flock perch in a rough circle around him and caw their applause. The most extraordinary rites of the flock, however, are the "trials" they conduct.

When a crow has committed an offense against the laws of crowdom, the flock gathers together in judgment. The offender perches on a branch at some distance from the rest of the assemblage, while the other crows hold a caucus, parleying sometimes for hours. Then the discussion suddenly ceases and there is a moment of silence, after which the flock either rises in unison and flaps away about its business or swoops down in a mass diye upon the offender, pecks his eyes out, and buffets him to death.

In autumn the small summer flocks of crows gradually merge together into larger flocks, and presently they make their way to their great winter roosts. These roosts are sometimes 1500 miles south of the summer feeding grounds. A Johns Hopkins scientist calculated that the crow population of a vast roost not far from Baltimore was 230,000. A roost near

Typical bird of the prairie, clad to harmonize with its surroundings, is—

The Clay-colored Sparrow

Photographs copyright by the Author

By H. H. PITTMAN

ON THE prairies where little poplar thickets taper down to the borders of silvery wolf-willows, in patches of dwarf wild roses, or in the snow-berry-clad knolls beside deserted badger dens, we may confidently expect to find clay-colored sparrows. While they are not strictly ground-birds, they are next door to it, for they live in a narrow or shallow zone in the shortest and scantiest brush. They are really small sparrows, but, their tails being rather long, the birds have an official average measurement of a little more than five inches.

The sparrows form a large and important family that is widely distributed throughout North America in every kind of habitat, from the Arctic to the Tropics. Although some are distinctively-colored, a number are so soberly-marked and inconspicuous that the novice may easily confuse them. Several kinds are superficially very similar in appearance, and even the painstaking field naturalist, if his knowledge be confined to brief glimpses over a period of years, can make mistakes in identification.

The family is an interesting one, however, and the serious efforts necessary to acquire information are well worth while. Beginners will probably find it

easiest to proceed by a process of elimination, crossing out those with easily-recognized colors, songs or habits, or with clearly-defined ranges. From the remainder the observer should be able to rule out one or two others well known in his district. Reduced in this way, the list of species to which one must give careful attention becomes less formidable, and the student will find that identification of the kinds most likely to be met with in his own particular area do not present insurmountable difficulties.

Clay-colored sparrows are rather typical prairie birds, with pale plumage harmonizing with the neutral browns and grays of the great plains. They have been described as ashy or earth-colored, but the back is really buff and brown and the breast white. They have a collar or mantle of pale gray, but sometimes this is not well-defined and might be better described as a suffusion than a color. The crown is dark brown, and in typical plumage should have a white or cream median stripe, which must be looked for carefully as it serves to distinguish this species from Brewer's sparrow. There is a distinct cheek patch, but the other face markings are not as clear-cut as those of the chipping sparrow. Altogether they are incon-

This nest of the clay-colored sparrow was in a small patch of snowberry bushes within three feet of the home of a yellow warbler. When facing the observer in an alert attitude, the face pattern is interesting and distinctive.



spicuous little birds, unless moving or close at hand.

Clay-colored sparrows spend most of their time in the undergrowth, and their presence might easily be unsuspected if it were not for their peculiar song—a buzzing that to me always suggests the winding of a cheap watch. While so many birds rise to a prominent position to sing, these birds often select the most hidden places. I have frequently heard the song from a little clump of bushes hardly bigger than a table-cloth, without being able to spot the vocalist.

Except when gathering nesting material they are rarely seen on the ground, and almost never in the trees. I cannot recollect ever seeing one on a branch more than ten feet from the ground. Some years ago I noticed what appeared to be a new and strange little bird feeding on scattered weed seeds in a Saskatchewan corral and captured it in a landing-net, only to find it was a clay-colored sparrow.

The nest is a rather frail example of bird architecture, and is rarely more than eighteen inches from the ground. I once found one in a small patch of snowberry bushes about three feet away from the home of a pair of yellow warblers. While photographing the birds feeding their chicks I was astonished to find that the male warbler was also contributing supplies. I was too much surprised on his first visit to release the camera shutter, but fortunately he gave me another opportunity later on. He made several visits during the absence of the sparrows but finally one returned while he was there and attacked him. Both birds hovered, fighting in the air in front of my hiding-tent with rapidly-beating wings before sinking to the ground to rest. Before the sparrow had recovered, the warbler retreated and I did not see him again during that afternoon. While hovering, with every feather raised and wings and tail wide-spread, the warbler looked like a little ball of flame.

While walking across the thinly-grassed spot on the prairie, I once flushed a small bird without seeing it plainly or noting the exact place from which it rose. Dropping a handkerchief as a marker I commenced looking for a nest, but it was only after a prolonged search on my hands and knees, during which every little tussock of grass had been parted, that I

found a nest of a clay-colored sparrow—the first and only one I have seen actually resting on the ground. On another occasion, in the same district, I found one about three feet up in a willow on the edge of a thicket.

Clay-colored sparrows are often imposed upon by the parasitic cowbird, and a large number of sparrow

chicks disappear in one way or another before the large intruders are able to leave the nests and fend for themselves. Once, while trying to photograph a white admiral butterfly in a tiny poplar and willow-ringed slough, I accidentally discovered a young cowbird sitting on (not in) a sparrow's nest in a dense tangled growth of snowberry bushes. As the shadows were too deep for rapid exposures I set up a dead branch in the sunlight and retired to a hiding tent a short distance



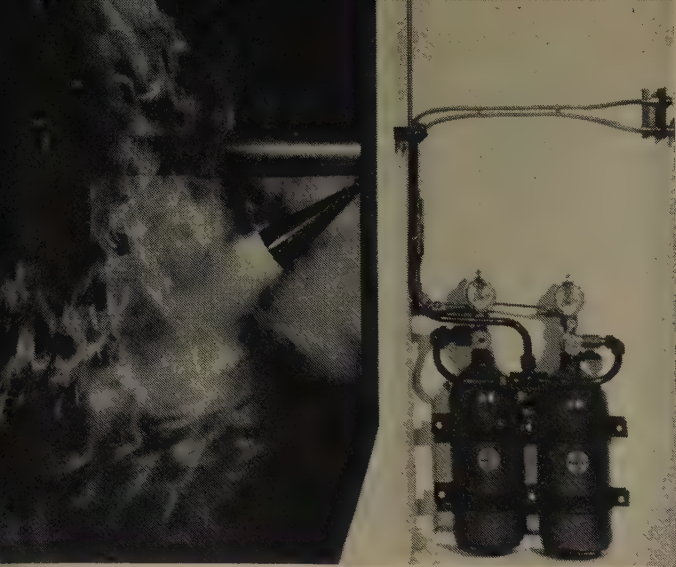
The clay-colored sparrow spends most of its time in the undergrowth, and is seldom seen on a branch more than ten feet above ground.

away. The birds returned quickly and settled on the branch twice, but after that they seemed to avoid it. When an hour had passed I began to think something was wrong, and sixty minutes later I was convinced of it. Upon investigating I found that they had quietly coaxed the cowbird off the nest and were feeding it in the undergrowth several yards away. These little depressions exclude the wind and are like ovens on hot days, but although I had been uncomfortable for two hours I could not help feeling amused at the way I had been outwitted.

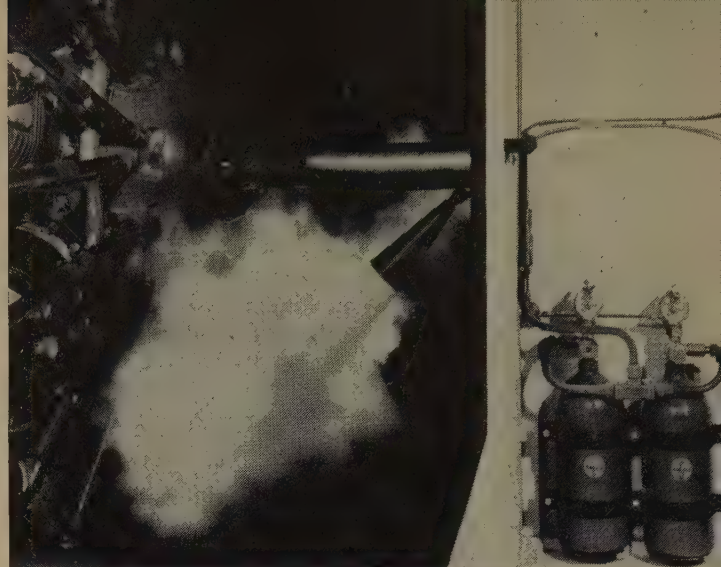
The light-colored nest is built of fine dead grass and is sometimes so poorly constructed that it threatens to collapse before the young ones are ready to leave. The eggs, however, are perhaps the prettiest laid by any member of this family. Blue or bluish-green, sparingly marked with black and dark brown, they have been described as looking like jewels in a casket.

Clay-colored sparrows are true dwellers of the northern prairie, and I have found them in Manitoba, Saskatchewan and Alberta wherever scattered patches of wolf-willows, snowberry bushes or dwarf roses occurred. In such places any small pale unobtrusive sparrow with a long tail will very probably prove to be of this species, and identification will be certain if the song is a flat buzzing one, for no other prairie bird has a call like it. It will be proof positive.

"To the Nature lover the universe constantly pours out its wealth. Daily he gathers the fruits of seed sown in the beginning of the world." E. A. PREBLE.



re has broken out in a radial, airplane type tank engine and the driver has just pulled the extinguish-control handle, which looses the carbon dioxide into the base of the flame. Photographs from Walter Kidde.



Two seconds later the fire has been extinguished and all that is left is a cloud of smothering gas that has reduced the oxygen content of the surrounding air to the point at which fire cannot even momentarily exist.

*For the saving of lives, for fighting fires
and for many other uses, carbon dioxide is—*

War Gas Number One

By E. E. STANFORD

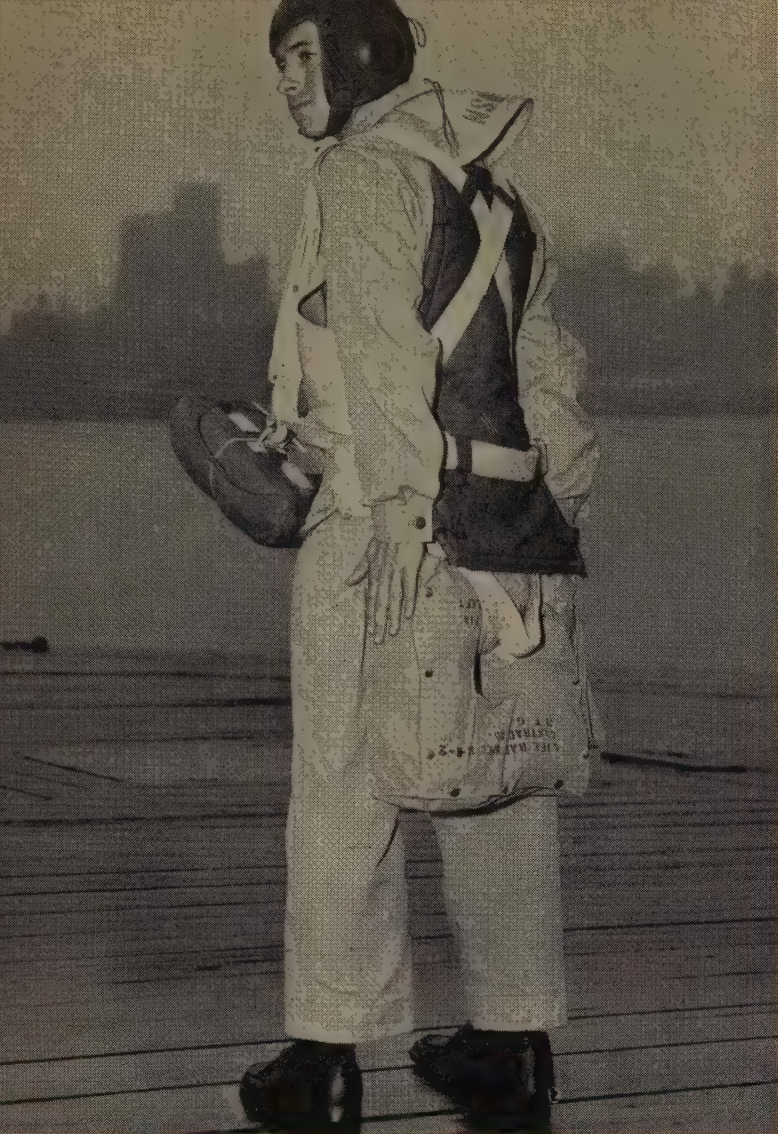
LURKING as a war threat is poison gas, yet the preeminent gas of World War II is not, properly speaking, poisonous at all. Its chief war-time uses, and its purposes in the world of Nature are not to destroy life, but rather to make life possible and to prolong it. Man makes this gas in abundance. Nature herself is prodigal of it. It bubbles from wells and mineral springs. Washed from the air in mist and rain, it corrodes the marble of colonial graves.

In the "waters under the earth" it leached the dark caverns along the Mississippi where Tom Sawyer and his Becky lost themselves. It is the architect of Luray and the wonderful Caverns of Carlsbad. Green leaves take it from the air to feed the world. We swallow it in "coke" and root beer. We eat it in every loaf of bread. We exhale it with very breath.

That gas is carbon dioxide, the CO_2 of the chemical laboratory. United States industry made and purified

The Caterpillar Club gets a new member who has arrived by parachute only six seconds ago. Already the carbon dioxide released from the cylinder attached to the life raft has almost filled the boat. Photograph from the United States Rubber Company.





Clad in a new, one-man parachute boat made by United States Rubber Company. Held tightly to a parachuting flier, the boat can be inflated in five to ten seconds by just turning a valve.

There is a lot of CO_2 in ocean water, too, and a lot of water in the oceans. Sea plants—microscopic, most of them—use it there, and we use huge quantities of clams, oysters, lobsters and Pacific salmon, sardines, herring and tuna, cod and halibut and shark liver oil for the children and the chickens. We would get none of these if Neptune should suddenly shut up in some insoluble form all the carbon dioxide in Davy Jones' locker.

To get back on the firmer ground of land, not only potatoes, but wheat for ourselves and our allies, cotton for uniforms and linen for handkerchiefs, wood for plywood airplanes, rubber for life rafts, and all manner of other vegetable products come to us thanks to the carbon dioxide content of the atmosphere. Carbon dioxide, in fact, supports the whole system of natural food manufacture. Experiments have shown that increasing the amount in the air stimulates plant growth, but there seems to be no hope of so using it to step up wartime crops of potatoes, or wheat, or cotton, or peanuts. The reservoir of the atmosphere is too big and gases diffuse too fast in it. To try to enrich it through any possible source of carbon dioxide would be like trying to alter a dirigible's sustaining gas by pumping in something by a surgeon's hypodermic needle.

The relationship of CO_2 to food-making has been known for a long time (as scientific time goes), but how the green plant does the job is something else again. We can ration a plant's carbon dioxide and water; we can measure the light it takes in and figure what amounts of its energy are stored as calories in potatoes or kernels of corn. We can determine that not only light but enzymes are concerned in the process of food building. We can weigh the built-up product and analyze it in terms of sugar, spice, starch, vitamins, and cellulose. We can burn these all up and get the carbon dioxide and water back again—as Nature does sooner or later when foods are eaten, or when plants or animals die to start her cycles anew. But between the intake of gas and water and appearance of sugar and starch are details of all-but-infinite complexity accomplished in space that is all-but-infinitesimal, yet allows room for other little-understood vital processes to go on concurrently with the food building.

Scientists, of course, have been trying to “unscrew the inscrutable” mysteries of photosynthesis for a long time. There has been employed in some of the latest work carbon dioxide whose carbon has been made radioactive by the cyclotron. With an ingenious

nearly half a million pounds of it annually in pre-war years. Tremendous volumes more were wasted in combustion and fermentation industries, and losses from gas wells. How much is being produced now, we shall learn only when the war is over.

About carbon dioxide, then, there is nothing new. As the earth cooled from incandescence, it may well have been among the first components of the forming atmosphere. Speculative minds have suggested that large measures of it—persisting in the air of the Carboniferous Period—may have stimulated that lush vegetation whose fossilized energies we tap for peace and ravage for war in coal measures and oil-wells. There is not much carbon dioxide in the air now—only about three hundredths of one per cent. Even at that, could a potato plant abstract all the carbon dioxide from a fair-sized room, combine with it several times its weight of water and a necessary pinch of minerals, it could build a good-sized hill of tubers. Somebody with a mind for higher vegetable mathematics has computed that the whole atmosphere of the earth contains something like two trillion, two hundred billion tons of carbon dioxide—enough, if combined, to supply spuds for quite a lot of K.P. duty.

Ginger Rogers dances through and seemingly upon filmy mists of carbon dioxide and steam in Paramount's "Lady in the Dark." Playing a repressed, neurotic magazine editor (sic), she dreams this.

device called a Geiger counter, radioactive carbon may be readily traced through the living mechanism of the plant. Results of this research so far seem to be expressable only in highly biochemical terms. They do seem, however, to have exploded a long-popular theory that formaldehyde was a way station on the road from carbon dioxide to sugar, and to have indicated also that some other theories of the action of the green matter—chlorophyll—are likewise erroneous. While such findings may seem largely negative in value, even negative steps that eliminate supposed possibilities may thus turn research toward something more positive. If we could make out the details of photosynthesis, we *might* be able to build sugars and starch from the gas-wastes of factories and coke ovens and lime-kilns—if not in time to affect the present war, perhaps in time to stop future ones. When nations lack enough to eat, revolutions and wars are pretty likely to start.

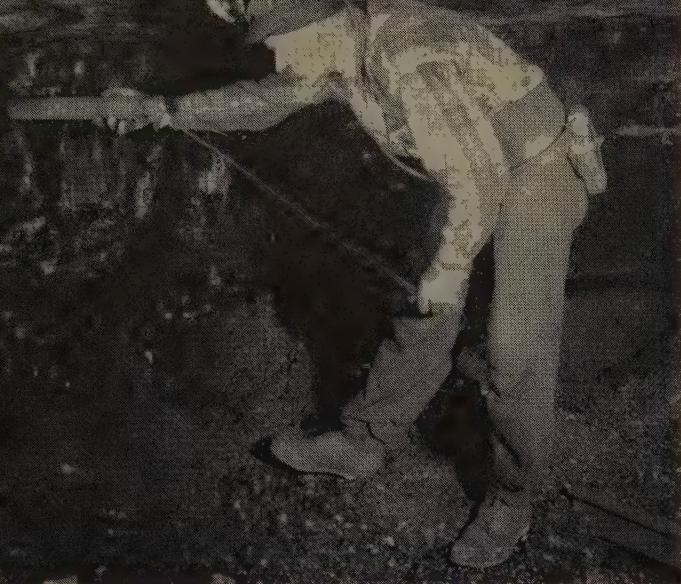
As builder of carbon foodstuffs, the green plant working in the sunlight is so much the world's prime mover that it is commonly supposed to be a monopolist of such manufacture. Scientists have long known, however, that some soil bacteria living in the dark also use carbon dioxide. We used to think that CO_2 liberated in human and animal systems was a waste product pure and simple. Later we discovered that the main factor that regulates the breathing rate—hurries it in violent exercise, paces it with slow regularity in peaceful slumber—is the carbon dioxide content of the circulating blood, acting through the nervous system. Thanks to CO_2 , we do not have to remember to breathe. Among the dangers of high altitude flying is the peril of carbon dioxide exhaustion, which might fatally stop the breathing apparatus. This and some other high altitude dangers are minimized through the invention of the pressure cabin and by various means of supplying aviators in the stratosphere with sufficient oxygen. Through respiration, this oxygen is turned by the body's chemistry into carbon dioxide.

Recent work, moreover, indicates that protozoa and higher animals make food-use of this product, which was once considered one hundred per cent waste for such purposes. It seems quite probable, in fact, that many if not all kinds of living cells may have some ability to utilize carbon dioxide. In these days of food-lacks and scarcities, this is at least a cheerful thought. In organisms large enough to have such things, the job seems to center in the liver. Add this to what we have also found out about the



liver's connection with vitamins, and it is evident that we have not half appreciated that massive though unhandsome gland.

Carbon dioxide has its medicinal uses too. The bubbling ferocity of the Seidlitz powder, the gentler simmer of the lithia tablet Grandpa took for his "rheumatiz," and the froth of the seltzer remedies for "morning after" are all CO_2 . Quite possibly the medicinal effects of all these are enhanced by the evidence that "something is going on" both before and after taking. Carbon dioxide livens the water of such mineral springs as those at Saratoga, and some of the benefits of baths therein have been attributed to the massaging effect of myriad tiny bubbles upon the human epidermis! However hypothetical may be some of these values, carbon dioxide has a real place in medicine and also in surgery. It is sometimes used to treat poisoning by its rascally relative, carbon monoxide. In hospitals, military and otherwise, it may be employed as a respiratory stimulant during anesthesia. Probably its most important hospital use, however, is as a refrigerant, outside rather than within the body. If a moist object such as a piece of human tissue be placed on a perforated metal disk,



When the gas in this long, slender cartridge of carbon dioxide is released, the coal will be broken out with a minimum of destructive shattering. Photograph from the Cardox Corporation.



Remember these? They are liquid center golf ball cores chilled solid by the "dry ice." Thus cold, they are to be wrapped to provide these disappearing items. Photo from Liquid Carbonic Corp.

through which liquid carbon dioxide is allowed to evaporate, the tissue quickly freezes. With a suitably-devised knife, or microtome, the tissue may then be cut into thin sections for microscopic examination. Observations thus made guide the surgeon in operation. Multitudes—soldiers, sailors, and just plain people—are now alive who have no idea that carbon dioxide had any part in "the operation" whose details they so avidly retail.

Carbon dioxide not only makes food; it also preserves it. Its best known use here is in refrigeration. Also, if the air of storage rooms or packages is enriched with carbon dioxide, spoilage and vitamin-loss in fruits and vegetables may be retarded. The gas is also employed in the dehydrating industries, so important in Lend-Lease and armed service provisioning. First, carbon dioxide snow is weighed into an empty can. Dried cabbages or carrots follow. The can is then placed in a trough of water, whose higher temperature quickly volatilizes the carbon dioxide. When this has sufficiently replaced the air, the can is sealed. The inert gas lengthens storage life, preserves palatability, color and, more important, vitamin content. Cans and packages containing carbon dioxide, moreover, are readily tested for leakage.

As for refrigeration, the compressibility of carbon dioxide, and its quick expansion from liquid or solid, are known to every youngster who ever patronized a soda fountain or carried home ice cream chilled by "dry ice." In peacetime, soft drink and refrigerant uses probably consume more carbon dioxide than all other employments of the gas combined. While huge quantities are still used in refrigerator cars, in storage plants, and on shipboard, in the war effort some of the more convenient and familiar employments diminish in part because volumes of soft drinks and ice cream are cut. The dry ice that was not used to pack

the ice cream you could not get for the party you did not give last week may be chilling something refreshingly cold for a doughboy in desert practice in California. Or it may be refrigerating aluminum alloys or cold-shrinking valve inserts and other metal parts in some aircraft plant in Los Angeles or Seattle or Willow Run. In peacetime, carbon dioxide chills liquid centers of golf-balls. These frozen pills are wound with elastic rubber, the outside is molded on, and the ball is ready to go. In war and peace, metal parts as large as trunnion shafts of bridges are chilled before placing in position. As they reach ordinary temperature, such metal parts expand into immobility. Dry ice cold also is used in testing aviation instruments, which must presently perform with utmost accuracy in the chill of the stratosphere. In modern metallurgy, carbon dioxide serves other purposes, some of which, perhaps, our enemies have learned of only through their results.

Odd-job uses of carbon dioxide are as many and varied as the miscellanies of a New England farm auction. In the course of a year, the "movies" use everything, including carbon dioxide. In a picture recently released, a battery of "cloud cookers" released a vapor of steam and carbon dioxide intended to create an unearthly and vaporous effect in which the characters appeared to be walking and dancing through space. The weight of the gas was supposed to keep it close to the floor, but the swirling skirts of the star once swirled up so much of it that she had to have a bit of first aid.

Many direct wartime uses of carbon dioxide derive from its failure to support combustion. The smoldering out of a candle is an old test for the presence of carbon dioxide—"choke damp"—in mines and wells. As early as 1882 a German named Raydt devised a carbon dioxide fire-extin- (Continued on page 444)

We will appreciate the symbolism and beauty that the Chinese see in this plant if we use—

Bamboo for Garden Charm

By MABEL IRENE HUGGINS

Paintings of bamboo by the famous contemporary artist, Ch'en Han-ti.

Poetry of Ou-yang Hsiu and Wang Wei translated by Helen Wiley Dutton. Used with her permission.

ELEVEN centuries ago a famous Chinese poet, Po Chü-i, asked, "What could I do to ease a rustic heart?" His answer was the planting of a hundred bamboo shoots, which grew by the streamside and made him feel that he was again enjoying life in the hills. His bamboos made him conscious of a fresher air moving through his house and garden. He liked especially

"To hear in their branches the sound of the autumn wind."

Sound is an important element of beauty in Chinese gardens. This musical effect of wind-blown bamboos was recognized by another poet, Ou-yang Hsiu (A.D. 1007-1072), who expressed his observation in these lines:

"..... the wind is in the bamboos
Tapping out its autumn music."

A bamboo grove that could be played upon by the wind thus inspired a lute-playing Nature lover, the poet Wang Wei (A.D. 699-759) in a record of a night when no breeze stirred:

"I sit alone in the dark silent bamboos,
Playing my lute and whistling a song.
The forest is deep, and no man knows I am there—
Only my friend, the bright moon, shines upon my solitude."

But there was not always solitude amidst bamboos. According to legend there existed a third-century men's club known as the Seven Worthies of the Bamboo grove. These cronies held frequent meetings in a bamboo-encircled spot, where they enjoyed the four scholarly accomplishments—music, chess,



books, and pictures. Doubtless the bamboo helped.

Throughout the centuries, there has been no group more sensitive to Nature than Chinese painters. In their landscapes bamboos often surround an open-fronted hut or cottage, within which a scholar may be seated thrumming his lute. Or, nestling among the hills, there may be bamboo groves through which mist-ribbons are threading their way. Some of the great artists did not make landscapes, but preferred to "write" only a few nodes from a cane or two—these simple brush strokes being accompanied by some twigs and leaves. Perhaps the most famous of these bamboo painters worked during the Yüan dynasty (A.D. 1277-1368), although even down to the present Chinese artists continue to try their skill at depicting bamboo as influenced by every varying mood of weather—rain, snow, and wind. Among contemporaries, one of the most noted is Ch'en Han-ti, who gives his energies to the constant practice of

bamboo painting. Bamboo has also been a favored motif of craftsmen who have used it in the decoration of porcelain, wood, pewter, and embroidered articles.

Much of the art and thinking of the Chinese is enriched by symbolism. In this, an important place is taken by bamboo, which is one of the numerous emblems of long life. Sometimes it also symbolizes wisdom. Usually the plum is emblematic of winter, but occasionally the bamboo is substituted. The plum, the bamboo, and the pine are often called the "three friends who go through adversity together." This is because the bamboo and the pine remain green through winter, and the plum blooms while it is still cold.

Aside from the legend that has already been mentioned, there are others in which bamboo features largely. One is the story of the filial son whose mother begged for soup made from young bamboo shoots. Although it was mid-winter and he knew his search would be fruitless, he set out toward the woods. As he arrived amidst the bamboos, a miracle happened and great numbers of shoots pushed through the soil, thus making it possible for him to gratify his mother's wish. Another legend accounts for the name of the spotted bamboo. It tells of the great sorrow of the two wives of Emperor Shun when he died 2208 B.C. Their tears, like a tropical shower, fell upon the bamboos surrounding his grave and left permanent spots, which, through the intervening years, have differentiated this variety from all others.

Already there are people in America who have recognized that bamboo, through its association with Chinese poetry, art, symbolism, and legend, has acquired a romantic charm that may be a great asset to our gardens. In the South and in California adventurous experimenters have introduced it with much success, but thus far its cultivation has been quite generally limited to these warmer regions in our country.

People usually assume—and wrongly—that bamboo is strictly a tropical plant. As a matter of fact, hardy



varieties withstand the cold winters of Japan and the still lower temperatures of North China. In my own garden in Peking, vigorous clumps of bamboo never winter-killed. In America a few isolated plantings are known in as cold and as widely separated localities as Boston and eastern Kansas. There are many other areas that are wholly suited to its culture, and to these districts its popularity will doubtless spread as soon as people learn the ease of its cultivation.

Unfortunately it cannot be introduced into arid sections because a prime requisite for all bamboos is ample moisture during the period of growth. In the wet, midsummer growing season in Peking, I have seen new culms shoot

upwards thirteen inches within a twenty-four hour period, a rate that seems slowed down when compared with a reported twenty-five inches per day in South China and thirty inches per day in southern Florida.

The many varieties fall into two divisions according to habits of growth. The commercial types send out runners in all directions and are therefore suited to the development of plantations. The kinds that grow in pretty well-defined clumps, however, are the ones that should be selected for garden and hedge plantings in regions that are warm enough. The hardy kinds are all of the running type, but can be controlled by cutting the shoots. *Sasa japonica*, both hardy and handsome, is a suitable variety for ornamental purposes in cooler regions.

Detailed suggestions in regard to bamboo culture, as well as information about obtaining roots, will be provided upon request by the Department of Agriculture, Washington, D. C.

There is no better way to introduce a poetic quality into our gardens than by planting bamboo. The person who plants only a few roots will have some understanding of the gladness of the Chinese poet who planted one hundred. He will understand, also, why the Chinese character for "glad" is a combination of the symbols representing "sky" and "bamboo."

"At the gates of the forest, the surprised man of the world is forced to leave his city estimates of great and small, wise and foolish. . . . Cities give not the human senses room enough." —EMERSON.

Scientific names lose their mystery and awesome character if we will try to discover—

What's in A Name?

By HENRICKS HODGE

THEY stare at you from seed catalogs and horticultural literature. They peer at you from the metal tags on nursery stock. To many they are terrifying. Yet, they are merely harmless scientific names of plants.

Every known living thing possesses a scientific name, compounded from either Greek or Latin. With plants, for example, such an appellation is given soon after its discovery, and often long before a "civilized" popular name comes into use. The English language, like most others, is full of Latin and Greek derivatives, yet let a person call our delicately-fragrant mayflower *Epigaea repens* and the layman is likely to protest—"What an awful name!"

Actually these scientific words are not so frightening. Our friend who protests so at the term *Epigaea* probably rattles off *Zinnia*, *Cosmos*, *Petunia*, *Dahlia*, *Chrysanthemum*, *Sassafras*, *Hibiscus*, and even *Rhododendron*, as though he were saying his ABC's. Yet every one of these names is a scientific name, and, what is more, they are Latin or Latinized Greek. So it is familiarity, or lack of it, that decides whether a Latin name is awful or all right. Laymen should get real enjoyment even from the so-called awful names, for with few exceptions scientific names of plants—

or animals—express in their origin or meaning rhyme, reason, and even romance. Just to prove this, let us explore the plant world for a few samples.

To begin with we must delve a little into the why and wherefore of the scientific name. During the great age of discovery and exploration, in the Fifteenth and Sixteenth Centuries, collections of plants were funnelled into the museums of Europe in tremendous quantities. This created a need for some system of classification to bring order out of chaos. Many systems were attempted, but it remained for the Swedish naturalist Linnaeus to give to the world, in 1753, the present scheme. This is known as the binomial system. If we think modern scientific names are difficult, we should glance backward to the years prior to 1753, when names were expressed not by two words but were expanded into sentences—and even paragraphs! For instance, before Linnaeus, a European *Gypsophila* (baby's breath) went under the following name: *Caryophyllum saxatilis foliis gramineis, umbellatis corymbis*. Reducing such names to two words was certainly a godsend. No one knows where Linnaeus got his system, but possibly the idea was borrowed from mankind's custom of linking a given name with a surname. At any rate scientific ap-

This is *Fittonia argyroneura*. The generic name is commemorative of Elizabeth and Sarah Mary Fitton, authors of *Conversations on Botany*. The specific name breaks down into *argyro*, meaning silver, and *neura*, meaning veins. Thus we have an interesting and descriptive scientific name.



pellations are easily explained by comparison with ordinary family names.

To get the proper order in this comparison the last name must be written first, just as in a telephone directory. For instance, compare the name John Smith with the name *Epigaea repens*. The surname, Smith, corresponds with the generic or genus name, *Epigaea*. Like Smith, *Epigaea* must always be capitalized because it is a proper noun standing for a certain grouping of plants all closely related—just as closely related as would be relatives or members of the immediate family of John Smith. Just as the given name, John, indicates with which Smith—not Paul, Mary, or Abigail—we are dealing, so the name *repens* indicates which *Epigaea* we are dealing with. For this reason the second scientific word of the binomial is known as the specific or species name. The scientific specific appellation differs from the name John in at least one way—it is generally a descriptive adjective rather than a noun, and is not capitalized.

Of course *Epigaea repens* is Latin. This dead tongue is the tool of natural science because the language is stable, unchanging, and in worldwide scientific use. Scientists in Russia or Fiji, Siam or Argentina, usually know Latin, and its universality thus makes it practical. Not so our common names, for although a “rose by any other name would smell as sweet,” still its identity may be jeopardized by too many common names. Our widespread white water lily has 205 common names—fifteen English, forty-four French,

one hundred five German, and forty-one Dutch! But let one say *Nymphaea odorata*, the earliest scientific name, and immediately you know what plant he is talking about. *Epigaea repens* is known to New Englanders as arbutus, but on the Pacific Coast arbutus is quite a different plant. These examples show the necessity for a name of universal application.

It is true that this system, as nearly perfect as it is, is not in itself infallible. The main trouble hinges on the occasional difficulty in identifying exactly the species that was before the botanist when he bestowed a particular name, or because our concept of the genus may have changed, necessitating some new names. Then, too, many plants are found in both the Old World and the New, and authorities may differ as to the value of slight differences in characters as meriting recognition by name. Such differences of opinion have resulted in much confusion, and some incongruities still clutter our lists.

Although our Latin names look like tongue-twisters, the majority are not, and unlike most common names they are often highly descriptive and may even be beautiful in sound. If one had never seen the familiar word *Chrysanthemum* it would look pretty bad, yet it rolls off the average person's tongue like water off a duck's back. The first known *Chrysanthemum* flower, apparently, was yellow, for this is a translation of the genus name. To refer again to the genus *Epigaea*, we find that it translates into *Epi* (upon) and *-gaea* (ground). If to this we now add

***Sempervivum tectorum*.** Translating this, we find that *semper* means always or forever, and *vivum* means alive, while *tectorum*, freely translated, gives us “That which covers.” Thus we have live-forever that covers, and has reference to the plant's characteristic of constantly sending off shoots that easily root in walls, house roofs, and elsewhere.



Ammophila breviligulata. Ammo gives us sand; phila, lover; brevi, short; ligulata, ligule. Hence this is the sand lover with the short ligule. This is a simple, interesting and descriptive scientific name.

the specific name *repens* (creeping) and translate the whole binomial, we see that the habit of the mayflower is admirably and beautifully described in its scientific name—a plant “trailing upon the ground.”

Many names like *Epigaea*, describing peculiarities of the plant, are descriptive. Similar are *Helianthus* (“sun flower,” when literally translated); *Sempervivum* (literally “live-forever”); and *Trifolium* (“three-leaved”), the name of our clovers.

Still other Latin names may be fanciful. The genius *Iris*, because of its variety of delicate colors, is named after the Greek goddess of the rainbow; *Narcissus*, the daffodil, got its name from the Greek youth in mythology who fell in love with his own reflection. *Dahlia*, *Forsythia*, and *Zinnia* are commemorative names—in honor of the men, Dahl, Forsythe, and Zinn, names connected with the discovery or early history of these plants. Names of this type may not always be as flattering as they appear. A certain bird species of Malaysia was named by its discoverer in supposed honor of his wife. She probably did not know that its common name was



tyrant bird! Even Linnaeus had his own fun with names. He named a species *Browallia elata* (“exalted”) after his botanically-minded friend, Bishop Browall. Subsequently his opinion of the cleric changed and he re-named the plant *Browallia demissa* (“deceased”) — a privilege no longer permitted. A few generic names stem from native tongues or dialects and thus represent old aboriginal names. Such are *Ginkgo* (a Chinese name), and *Sassafras* (an American Indian name).

Species names (the second name of the binomial) are always adjectival, but like names of genera, may be descriptive, fanciful, or commemorative. In addition, they are often geographical, indicating the locality where the plant is found. The New Eng-

land aster, *Aster novae-angliae*, would be an example of this type.

One can easily see that this business of plant nomenclature is not a helter-skelter affair, but like everything else, in order to insure uniformity, follows a code of rules set up by groups of natural scientists. Once one gets on to the idea, scientific terms are not half as bad as they seem. So the next time you see or hear a Latin name, open your mind, for there is a good chance that it may be not unnecessarily complex after all, but rather in its meaning will probably prove to be enlightening and revealing.



Certitude

By PAUL H. OEHSER

The boy stood gazing out toward the sea,
Out where the evening sun had turned it red:
Here was his lesson in infinity . . .
“Space is the greatest thing of all,” he said.

“Greater than time and tide?” asked the man, “or
Than a snowflake, or a grain of sand?”
But the lad, intent, made no reply, nor
Turned his shining eyes back toward the land.

But the woman, standing by their side, smiled
To know she knew more than man and boy.
Nothing of earth or sea had yet beguiled
The certain knowledge of her boundless joy.

Although some travel east and some travel west, we know little about—

The Mysterious Eel

Illustrated by R. Bruce Horsfall

A FEW centuries ago the British Government had difficulty in obtaining sufficient nitrate of soda to manufacture gunpowder. Laws were passed authorizing those engaged in the production of this chemical to raid farmyards and seize the manure. As a substitute fertilizer the farmers were advised to excavate marl—a rich, clayey loam of which deposits are common in England—and mix it thoroughly with quicklime. The excavations for marl were made on the higher parts of a field and, while the pit that was left had neither inlet nor outlet for water, many of the pits contained a considerable amount of water from rainfall.

In the winter of 1886 a sharp frost gave us a week's skating in the marl pits. Often there was a little open water around the ice in the pits, and when we were skating the eels came up in the open water and put their noses out. One day I caught more than a dozen large silver eels by hand.

A couple of years later I called one evening at a farmhouse, and while I was talking to the farmer a boy from the neighborhood came to him and asked, "May I set a night-line for eels in your marl pit, Mr. Seed?" The farmer gave his permission, and we went over to the pond to watch the boy set the line. As we walked along the farmer said to me, "He will get a great disappointment. There was no water in the pit until the heavy rain day before yesterday." The boy drove stakes in the ground on opposite sides of the pond, and between them he drew a line on which he had put sixteen snelled hooks baited with worms. The next morning I saw the farmer again, and he told me that on the sixteen hooks the boy had caught fifteen large silver eels, and was far from disappointed.



"... eels went regularly from one pond to another, traveling readily over the ground."

By ROBERT A. SMITH

On my way home I met a gamekeeper carrying an eel spear, and I told him of the boy's success. He laughed and, leading me to another marl pit that had been dry until the rain two days before, he gave me my first lesson about eels. He said that he would throw his spear so that it would fall flat on the water, and when it splashed each eel in the pond would give a sudden start, move a short distance, and let a few bubbles of air out of its mouth. "We call this making a strike," he said. "Now count the strikes." He threw his spear and got more than thirty responses. He told me that eels went regularly from one pond to another, traveling readily over the ground.

These incidents led me to make some study of the known facts about eels. No scientist has ever seen an eel's egg, or a female eel ripe with spawn. Dredging carried on by boats of different nations has located the spawn-

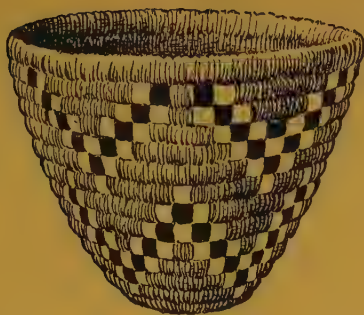
ing ground of eels about halfway between Bermuda and the Leeward Islands. When the young eels are hatched, those of European parentage start traveling eastward, and, in the course of some three years, they reach the fresh waters of Europe. Those of American parentage travel westward and spend about one year on their journey to America's fresh waters.

Only the female eels enter fresh water; the males remain in salt water and await their return. After seven years in fresh water the female eel changes from a brown-olive to a silver color, indicating that she is preparing for spawning and is about to undertake the long trip back to the West Indies. When she leaves fresh water and enters salt water she is joined by a male, and together they go to the spawning ground. After spawning is completed, it is believed that both parents die. (Continued on page 444)

The Tie That Binds

By

E. LAURENCE PALMER



*This is the twenty-sixth
in Nature Magazine's series
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Illustrations by Elizabeth Burckmyer, L. A. Fuertes, Mae Eltringham, and W. C. Baker.



BOW-STRING
HEMP



SISAL



JUTE

WE SPEAK these days of United Nations; of pulling together; of cooperative effort. It takes something in the nature of a bond. Nations need, to bind things together, race, religion, or, most important, conviction. And in any case we must also have material things to hold other material things together.

Even before Pearl Harbor we were told to conserve burlap sacks because we could not get all the raw materials needed to make them. The rubber bands we formerly carelessly used became precious. If we go mountain climbing, we are told that we should no longer depend on a three-eighth-inch rope because new ropes do not have enough manila fiber in them. Even the metal for wire with which to bale hay has gone to war.

Faced with these conditions, we must seek substitutes. We might first consider what primitive peoples used for fiber before we had rayon for socks, or cellophane ribbon to bind gift packages. It may pay us to know how to make a shoelace from Indian hemp, a garbage basket from willow withes, or a rope from basswood bark.

A few things are certain. The manila that was so useful in making ropes, particularly for marine use, came from the Philippines. Until Togo and Tojo are taught a lesson, we will have to do without new manila. The same goes for rubber, largely from the Malay area; for jute, from Burma and India; for silk from China and Japan, and for generous portions of our supply of other fibers from the regions now controlled by Asia's New Order. This insert seeks to help you know something of the fibers you have used and will use, how to identify them and how to recognize, process and use the various substitutes that must serve us for a while.

Roughly, the materials with which we bind things consist of raveled out plant fibers, split woods, sticks or roots, or such animal products as hair, hide or intestinal or glandular materials. Minerals that we make into wire, and the host of synthetic products the chemists are giving us are outside the scope of this article.

The common plant fibers include manila, jute, sisal, hemp, flax, nettle and cotton. In the various textiles and cordage we use, there is an increasing likelihood that cheaper, more abundant materials will be mixed with better, less common stuffs. Here are a few hints about identifying some of these. Other suggestions may be found in the chart section.

If you have a cord or rope in which there is a mixture of hemp, flax and jute these elements may be identified as follows: Untwist a piece of the cord or fabric to be studied so that the individual fibers stand out more or less distinctly. In a clean saucer, put a saturated solution of chloride of lime. Dip the fibers in this. Add a few drops of hydrochloric acid. There will



COTTON



BLACK ASH



BASSWOOD



FLAX



HEMP

Plant fibers useful in tying things may be had in various forms. Such plants as basket willows, rattan, and the like, yield long sticks, which, with a little treatment, may be tied or woven as desired. Other plants, like basswood and elm, have bark that may be ripped off in long, coarse strips to serve as crude ropes. Still other plants, like ash and hickory, may yield tough sticks that may be twisted or woven into strong fabrics or ropes. Some plants, like cattails and bulrushes, have long, slender leaves that may be twisted into surprisingly strong ropes for seating rush-bottomed chairs. And then, of course, there is the multitude of plants that yield fine, strong fibers that may be spun into cords or threads and twisted or woven as desired. Sometimes, as in cotton, these fibers come from the seeds. In others, as in flax, hemp, nettle, sisal, manila or jute, the fibers are imbedded in the tissue of the stems or leaves and must be extracted and processed before they are used.

Only in an emergency, or where a tree is doomed or too badly deformed to be of use, should one attempt to make a rope

be a slight disturbance; the liquid should become yellowish-green and the fibers should be bleached almost immediately. Now, wash the fibers and wring out the surplus liquid. Put the fibers in a clean dish and moisten them with a few drops of ammonia. Examine the fibers immediately. Jute fibers will take on a reddish-blue color; flax or hemp will be yellow, streaked with pink. If the same fibers are treated with a solution of iodine and water, the jute will assume a deep brown color, while the flax or hemp will become blue or violet. If treated with iodine and sulphuric acid, the jute will assume a yellow color.

Probably, the easiest way to distinguish between a cotton and a linen cloth is to rub it on dark wool cloth. The cotton will leave plenty of lint, while the linen should leave none. This difference is reflected in the clean-cut pattern that shows through a linen handkerchief held to the light as contrasted with the confused pattern of the cotton cloth. This is largely because the cotton fibers are less stiff than those in the linen.



BASKET
WILLOWS



MERINO SHEEP

from the bark of a standing tree. If you ever do need an emergency rope, an axe or hatchet may be driven at an angle into the bark of such a tree as a young slippery elm or basswood, and a rope substitute may be obtained by grasping the free end of the bark and pulling. The bark will come off in a long strip up the trunk and will yield a reasonably good rope. Leatherwood, *Dirca palustris*, has a rather wide range and can be used for emergency small cordage. In spite of the name, the wood is weak and rather useless, but the bark is tough and highly durable when twisted into a coarse cord. This plant is so beautiful when in bloom that I would not wish to make any suggestion that might lead to its wasteful use. The inner bark of many of the cedars yields an excellent, easily-processed fiber. Some of the baskets in our home, made of cedar bark by the Chehalis Indians of the Northwest, are woven so tightly that when well-soaked they will hold water almost as well as a bucket. Other trees whose inner bark makes good rope material include slippery elm, American elm, hickory, white oak, red cedar, osage orange, black locust, cypress and papaw.

In the sporting goods houses, we see beautiful pack baskets made of thin wooden splints. Sometimes, we buy "porch furniture" with woven splints for the seats or backs. Usually, these splints are of ash or hickory, black ash possibly being the most popular of all. These splints are not always easy to get, but they can still be obtained.

The best time of the year to get splints is in the spring when the "sap is in the wood." Cut a black ash tree, preferably one whose top has been so deformed that it never can be a superior timber tree. Lay the log on the ground and peel off the bark. Lay a board lengthwise on the wood. With the flat of an axe pound the board repeatedly, distributing the blows so that the ash wood is violently jarred but not struck directly. When at one end it seems evident that the wood in some of the annual rings has been jarred loose, make two knife-slashes in the end about three-fourths of an inch apart. Grasp the free end and start to strip off the splint. If it comes off with difficulty in any spot, tap the area with the board and axe until it can be broken loose. Continue in this way to strip off the needed splints. The splints will follow the grain, so it is not possible to get splints by splitting them off a sawed board that



CATTAIL



MANILA
HEMP



MILKWEED

does not follow the grain. If a board is "split" out of the ash log, splints may be stripped off it but this is not always the best way to get them. The splints may be stored until needed for use, but the longer they are kept the more likely they are to split or break when bent unless they are thoroughly steamed or soaked beforehand. Good splints may be made from a piece of ash or elm at least four inches in diameter by beating it with a wooden club until the layers have broken loose. The pieces are then stripped off and stored for use. Hickory splints may be made by splitting them off a split hickory board. A surprising variety of practical furniture may be made by an ingenious person with a good supply of fresh ash, elm, or hickory splints.

Probably the plants in the United States most used as sources of sticks for making furniture, clothes bas-

kets and the like are the willows. In America, the better willow species are the green willows, and the purple willows. One of the varieties of crack willow known as Küstermann's willow, *Salix fragilis triandra*, has been grown commercially in Wisconsin and Virginia, but does not compete in quality with the others mentioned. The true basket willow of Europe does not do well enough in America to compete with the species referred to. Some of the best willow withes in the world are produced in America but the labor costs are high and it is difficult to compete with the products produced where labor is not so well rewarded. Our willows can never produce woodenware with the strength of rattan and similar tropical woods. Rattan comes from a palm and probably will not be coming to America in any quantity while the war is on. Farmers' Bulletin 622, issued by the United States Department of Agriculture, will provide useful reading for anyone interested in raising willow withes for home use or for commercial reasons. Excellent withes may be had from hickory, white oak, black ash, birch, wild grape, witch hazel, chestnut or sweet gum, as well as from willow.

Most vines are flexible and many of them are strong enough to be used as cordage substitutes. Grapes probably offer the greatest promise of yielding a fair rope in a hurry in an emergency.

The underground parts of white spruce (split), cedar, hemlock, digger pine, fir, cottonwood, or long leaf pine, tamarack and brake fern yield a strong flexible material that, in an emergency, can be used

directly as a rope or cord. These may be softened by steaming or by boiling wood ashes in water ten minutes with the roots.

A variety of plants produce the rushes used in rush-bottomed chairs. Possibly, the most common of these are the cattails, which are to be found in abundance in shallow fresh waters in north temperate regions around the world. The leaves are used, and these are usually more or less uniform in size and shape and usually free from any important diseases that might disfigure them. They are cut in late summer and dried on racks or by being hung in bundles. Usually, this is done by September. The dried leaves may be stored and when ready for use may be freshened so that no serious injury results from twisting them.

There is not space here to go into the commercial uses and processes of cotton. What we do want to give help on are the means of getting fibers from plants. For the most part, plant fibers to be found in stems or leaves are surrounded by softer tissue that must be removed. This soft tissue generally rots before the harder fibrous material. The simplest procedure, then, is to permit rotting to take place

just long enough to destroy or weaken the soft tissue and not long enough to injure the desired fibers. This "rotting" is sometimes done by bundling the plant material and submerging it in water in such a way that it is not exposed to the air or forced into the mud at the bottom. At other times, the plant material is merely spread out flat on the ground and the dew and ground moisture are allowed to do their work.

After the tissues containing fiber have been rotted, the fibers must be removed. Sometimes this is done by running the plant between the fingers, forcing the soft tissue aside. At other times it is done by machines. Indian jute fiber is extracted from its tissue by native women, one of whom can strip about forty pounds of fiber a day. Once the fibers are free, they must be arranged so that they can be worked into a continuous thread, cord or rope.

In some of our native fiber plants such as milkweed and Indian hemp, the fibers must be separated from close-lying semi-woody material, which does not rot easily. Usually, this re- (Continued on page 424)



NETTLE



INDIAN HEMP



WHITE
CEDAR



POLYPHEMUS MOTH

COMMON NAME SCIENTIFIC NAME	BASSWOOD <i>Tilia americana</i>	WHITE CEDAR (1). ALASKA CYPRESS (2). <i>Chamaecyparis thyoides</i> (1). <i>C. nootkatenis</i> (2).	BASKET ASH BLACK ASH <i>Fraxinus nigra</i>	PURPLE WILLOW (1). GREEN WILLOW (2). <i>Salix purpurea</i> (1). <i>S. amygdalina</i> (2).
GENERAL DESCRIPTION	Tree, to 80 feet high, with trunk to 4 feet in diameter. Crown, dense and rounded; trunk, straight and slightly tapering, with dark gray, somewhat scaly, and deeply and regularly-fissured bark. Leaves: alternate, simple, unequally heart-shaped, with incurved, marginal teeth, and texture, firm. Roots, lateral, deep, spreading, without taproot.	(1) Tree, to 80 feet high; with reddish brown bark, fissured into flat, connected ridges; and with inner bark, that may be torn into long, strong strips. Branchlets flattened. Leaves with gland on back. (2) Tree, to 120 feet high; with gray, brown bark, separated on surface into large, loose scales, and irregular fissures. Branchlets not flattened, but squarish. Leaf-backs glandless.	Tree, to 100 feet high, relatively slender, with a straight trunk, rather coarse twigs and branches. Bark: close, ash gray, without deep ridges but with thin scales. Rubbed bark breaks into fine powder. Twigs: smooth, dull, black-budded, with circular or semi-circular leaf-scars. Leaves: opposite, compounded of 7 to 11 stalkless, rounded-based leaflets, with shallow-toothed margins.	(1) Shrub, or small tree, with long, erect, uniformly diametered twigs. Leaves to 3 inches long, smooth, paler beneath, sometimes nearly opposite, and with short stalks, or none. (2) Shrub or small tree, to 30 feet high, with bark in flakes. Twigs long, and slender, but coarser than in (1). Leaves to 4 inches long, tapering pointed, light- or blue-green beneath.
RANGE AND HABITAT	Family Tiliaceae. A close relative of the linden. The family has about 370 species. This species is found from New Brunswick to Manitoba and south to Georgia and eastern Texas and is usually rather abundant within its range, though it does not occur in pure stands. It favors rich woods and loamy bottomlands.	Family Pinaceae. Six species of the genus in North America and eastern Asia. (1) Ranges from Maine to Florida, and west to Mississippi, being found mostly in swamps. (2) Ranges from Alaska to northern California, and in cultivation, in California and through the East; from sea-level to 3000 foot elevations, at the higher elevations appearing like a low shrub.	Family Oleaceae. Related to the olives, syringas and privets. This species rather uncommon in wet woods and swamps from Newfoundland to Manitoba, and south to Virginia and Arkansas. It does best in the cooler part of its range, seldom thriving on dry lands or on warm exposures. It will grow well mixed with spruce, fir and larch, in land too wet to support other forest trees.	(1) Native of Europe, but escaped and wild in North America, commonly planted for basketry in western New York. The true basket willow, <i>S. viminalis</i> is grown in the Northwest, but is useless in the East and South. (2) Popular in Europe and in America, particularly along the Mississippi where it withstands heavier soil and more water than does (1).
REPRODUCTION	Stamens and pistils, in fragrant, yellowish-white flowers borne in flat, drooping clusters in June and July. Pollination by insects, particularly bees, results in woody, spherical, pea-sized fruits, attached singly or in groups, on a wing, and distributed in October or fall by the wind. Seedlings: 1 to 2 inches high first year, with two, 4- to 5-lobed, palmate cotyledons.	Cones; of (1) about 1/4 inch across, bluish purple; of (2), nearly 1/2 inch across, and dark, reddish-brown. There are 1 or 2, winged seeds under each fertile scale, each with wings as broad as the dark, red-brown body; and the whole, about 1/8 inch long. The seeds are wind-borne, shed over a relatively long period of time, and produce 2-cotyledoned seedlings.	Pistils and stamens borne in separate flowers on the same or different trees. Stamens purple, and appear, with the pistils, before the leaves in spring (May). Pollination is probably by wind, and results in broadly winged fruits each with the seed-enclosing portion at one end, which are carried by the wind when shed in fall. Seedlings develop in spring.	Staminate flowers of (1) have 2 stamens; of (2), 3 stamens. Bracts of the pistillate flowers dark at the tip in (1) and light in (2). Leaf stalks of (1) without glands; of (2), with glands. Pollination is by wind or insects, and the seeds are distributed by wind when the fruits burst. Normal reproduction is by cuttings, which root freely.
CULTURE AND ENEMIES	Rarely attacked by fungi, although sometimes by a canker of the bark and a leaf spot; and by an insect pest, the basswood leaf-roller. The tree grows better in a mixed forest than alone, and does not resist wind injury well, or severe ice storms.	(1) Favors wet areas; produces a light, soft, weak, close-grained, light-brown to reddish, fragrant, uniform wood. (2) Produces a hard, close-grained, brittle, durable, bright yellow, fragrant wood with resinous quality, with a very thin, white sap-wood. This tree lends itself well to cultivation and is commonly grown as an ornamental.	Wood soft, tough, but not strong; dark brown, weighing 39 pounds to cubic foot; elastic, rather than brittle. If wood is steamed, it may be bent to desirable positions, which it holds. Tree is attacked by fungi and a few insects, including ash wood-borer, which destroys much valuable lumber, and spring canker-worm, which eats leaves, and lowers tree's vitality.	Cuttings, made 2 weeks after leaves fall, may be planted in spring, the shoots being about 1 year old and a foot long, or larger and older, for poorer ground. They are usually spaced about 18 inches or a yard apart, are cultivated the first 2 critical years; twigs are harvested in December or January, and yield may continue 25 years.
ECONOMIC IMPORTANCE	Inner bark yields a cordage fiber; whole bark, used by farmers for tying logs together. Inner bark has some edible qualities, and the buds are good to eat. Wood, valuable as "whitewood," is light, soft, moderately strong, fine-grained, white, weighs 28 pounds per cubic foot. Flowers, with help of bees, yield a superior honey.	(1) Wood is used in boat building, shingles, interior finish, fence-posts, railway ties, cabinet work, and woodware. (2) Wood is used in furniture, shipbuilding and in interior finish. Inner bark, of either, may be used as fiber of a primitive nature, particularly in making baskets that will hold water, as do some made by the Indians in the Northwest. See cut, p. 417.	Wood used in making skis, barrel hoops, baskets, splint-bottom furniture and for interior finish. Logs are cut in winter or spring, pounded with a board until the years' growths become separated, and then stripped through knives to make strips for weaving into baskets or for furniture seats. Also popular as a street tree.	Harvested rods are peeled, dried, packed and bundled. Profit of the yield of an acre may be around \$100 for the better years, although this implies that labor costs are low and that the land is not worth more than \$35 an acre for other purposes. Willow is grown locally or imported, but the centers in America are near the larger cities.

CATTAIL <i>Typha angustifolia</i>	COTTON <i>Gossypium hirsutum</i>	MANILA ABACÁ NE'E <i>Musa textilis</i>	INDIAN JUTE <i>Corchorus capsularis</i>	SISAL HEMP <i>Agave rigida (sisalana)</i>
Height, to 6 feet. Leaves, erect, flat, smooth, green ribbons, about 1/2 inch broad as contrasted with the inch-wide leaves of the broad-leaved cattail, considered in the second insert of this series. Underground, there is a stout, horizontal, perennial rootstock well stockied with starch, branching and giving rise to the leaves and flower-stalks.	Height, to 8 feet, much branched, but with one more or less central stem. General shape of plant like a cone. Leaves, variable, to 6 inches long and to 5 inches wide, heart-shaped, 3- to 7-lobed, and coarse-veined. Roots, a main tap root, and finely-divided, lateral roots that fill the soil. Sometimes described as "herbaceous shrubs." Annual.	Height, to 20 feet. General appearance almost identical with banana. Leaves often spotted, with the fiber found in the sheathing leaf-bases that form the 20-foot trunks. Like the banana, the plant is not a tree, nor is it a woody plant. Inner leaves the more valuable. A cut stem weighs from 20 to 80 pounds. Perennial.	Height, 15 feet. Stems straight, branching only near the top. Diameter, 1/2 inch. Leaves shaped somewhat like an arrow-head, to 4 inches long, and with basal teeth, sharp-pointed. In <i>C. capsularis</i> , leaves are bitter and seed-pods, spherical; in related <i>C. olitorius</i> , Desi or Nalta jute, the leaves are not bitter and the seed-pods are cylindrical.	Leaves, 8 to 10 feet long, average 6 feet by 4 1/2 inches wide, by 1/2 inch thick, with a tough, green skin, and pulpy interior mixed with fibers; about 3 1/2 to 5 percent of the leaf, fiber. Weight of leaf, 1 to 2 pounds. Stem erect, coarse, and, in cultivation, conspicuous, with diamond-shaped leaf-scars, cylindrical, barrel-shaped.
Class Monocotyledonae. Family Typhaceae. This species is native of Eurasia and other north temperate parts of the world and is found in America from southern Maine to North Carolina and west to the coast, but is most abundant near the coast. It has a more restricted range than the broad-leaved cattail and is rarely so abundant. Both grow in shallow waters or marsh lands.	Family Malvaceae. Related to the mallows. American cottons include: Upland cotton, <i>G. hirsutum</i> ; Sea-island cotton, <i>G. barbadense</i> ; Peruvian cotton, <i>G. peruvianum</i> . Asiatic cottons include: Indian cotton, <i>G. herbaceum</i> ; Bengal cotton, <i>G. neglectum</i> . Upland cotton constitutes about 99% of cotton grown in United States. Leading crop in Southern States.	Family Musaceae. Close relative to the banana and to many ornamentals. Grows best in the Philippines, especially on Luzon and to the south, where there is a warm, moist climate and a deep, rich, well-drained soil and 60 inches or more of annual rainfall. Attempts to introduce abacá into American tropics have failed, partly because of diseases.	Family Malvaceae. There are more than 20 races of Indian jute. Requires a rich, loose, sandy soil, with good drainage and climatic conditions such as are to be found in Burma, Bengal, southern China, northeastern India; and the southern islands of Japan. It does best on high lands, but is grown on lands that are flooded in the late summer season.	Family Amaryllidaceae. About 300 other species in the genus including the century plant or blue aloe, <i>A. americana</i> ; the small-leaved aloe, <i>A. angustifolia</i> and others. Sisal hemp also comes from <i>A. morrisi</i> and <i>A. vivipara</i> . Mauritius hemp comes from <i>Purcroya gigantea</i> . <i>A. rigida</i> is cultivated in the Bahamas, Cuba, Mexico, Florida and Northeast India. It is native of Yucatan.
Flowers appear in early summer and are either pistillate or staminate. The two are borne on the same erect stalk with the staminate at the top and separated slightly from the pistillate, a character which helps distinguish the two species. The pollen is wind-carried. The fruits are wind-carried when the spikes break during the winter or following spring. Seedlings grasslike.	Flowers on short stems, creamy white at opening, changing to red by second day. Sea-island cotton has yellow flowers. The "bolls", which develop from the flowers, may be 2 1/2 inches across and a good plant may bear to 50 bolls. Seeds planted 2 weeks after last killing frost produce plants that in September to November yield mature cotton.	Fruits inedible, with seeds the size of BB shot and borne on drooping spikes. Reproduces largely by sucker shoots. Field is cleared and burned, suckers planted and competitive weeds removed. Plants mature in about 3 years when they should be cut. Young leaves give weak fiber; older leaves, harsh, brittle fiber.	Annual. Flowers small, yellow, often solitary, mallow-like, with 5 petals, 5 sepals, and 10 or more stamens, which are free of each other. Seeds sown by hand, 10 to 15 pounds per acre, March to May; cultivated when plants are 6 inches high, and hoed thereafter; harvested from flowering to seed maturity, the earlier being the better.	Shoots are planted 4 feet apart, in rows 12 feet apart. In 4 or 5 years, or when leaves assume horizontal, first leaves may be cut. Plants allowed to bear 25 to 27 leaves and yield 12 to 15 a year cut at intervals. If leaves are not cut when mature, plant may send up 8- to 10-foot flower stalk and die. Properly handled, a plant may yield for 14 years in rocky soil, sometimes 1500 leaves.
Erect leaves expose a maximum surface to the sun when it is at an angle; a minimum surface when it is at its strongest or directly above. Creeping rootstocks submerged for a considerable portion of the year particularly when fire may sweep the exposed upper portions. Underground parts provide good food for muskrats, and the upper parts summer protection.	Require about 200 days with a mean summer temperature around 77° F., and rainfall after harvest of about 10 to 22 inches. May and June are critical months, and a rainy fall may ruin the harvest. The seed-hairs vary in length, strength and fineness in different cottons. Cotton-boll weevil principal insect pest.	Leaf-bases contain 90% water. Requires 5 acres of plants to yield 1 ton of fiber. The shoots cut are replaced by developing suckers. Around a million acres of land in Philippines yield annually 150,000 tons of manila fiber. Grades of manila fiber include, "current", "fair", "brown." Knotted abacá is hand-sorted and tied fiber.	Plants are cut, then held under water but off bottom at about 80° F. for 10 to 20 days when the fiber is extracted by running to 3 stalks at a time between the fingers, a woman being able to strip 40 pounds a day, for which wage has been the waste fiber to be used as fuel. Yield per acre about 1300 to 1800 pounds. Exported in 400 pound bales.	A bed of semi-decomposed coral rock, with hot, dry air, is best environment. In native Yucatan, a plant may yield twenty crops over a span of 25 years. If one plant in an area is allowed to produce its flower-stalk, nearby plants may, strangely enough, do the same and die, so a plantation requires care to have yield continued. 600 to 1200 plants to an acre.
Leaves of this and of the broad-leaved cattail may be cut in late summer, dried either on racks or in shooks, and twisted or braided into cords, which may be used in making rush-bottomed furniture. Staminate heads, harvested at their prime, yield a flour-like nutritious powder, the submerged rootstocks, a starchy food, and the plants, flood control.	The world's most important fiber crop, having been used since 1000 B.C. Next in importance as agricultural crop in United States to wheat, potatoes and corn, but leads in areas between 30° and 40° north or south of equator. Cottonseed valuable in industry for food and oil. In U. S. in 1941, two million acres yielded ten million bales worth nearly a billion dollars.	One of most valuable Philippine exports. Knotted abacá is twisted into skeins and then braided by hand or by simple machines in Japan. A piece 250 feet long and 1/8 inch wide brings, after all labor, only about 50 cents. Adding 15 minutes on an American machine it becomes a hemp hat, which a milliner sells Mrs. America for \$10.	India grows 3,000,000 acres of jute. Normal world yield, 1 to 2 million tons. Used in making burlap sacks, coarse cordage, twines, and some coarse papers. War disrupted export of jute to America and requires use of substitutes and wise use of remaining supplies.	Leaves are worked when green and fiber is removed by machines, but juice attacks wrought iron. Yellow leaves yield inferior fiber. Fiber is whiter, flatter and less pliable than manila. It is used in making ropes, nets, hammocks and cordage. Some sisal is extracted by steeping leaves in water 10 days after a 4-day drying and then beating fiber out.

COMMON NAME SCIENTIFIC NAME	BOW-STRING HEMP <i>Sansevieria zelanica</i>	NETTLE <i>Urtica dioica</i>	SOFT HEMP. MARIJUANA <i>Cannabis sativa</i>	MILKWEED <i>Asclepias syriaca</i>
GENERAL DESCRIPTION	Leaves, to 8 feet long, to 3 inches wide, springing directly from the foot, since the plant has no stem above-ground. Leaves rounded on the back, with dark green, longitudinal lines on back and lighter green, transverse lines on inner face. A number of varieties differ by color, and banding of the leaves.	Height, to 1 foot; related <i>U. gracilis</i> , to 10 feet. Covered with bristling, stinging hairs. Leaves on short stalks, less than half the leaf-width, with coarsely-cut margins, and downy undersurface; heart-shaped at the base. Stinging nettle of the Southern States is <i>Jatropha stimulosa</i> , an entirely different plant.	Height, to 12 feet, with stalks 1/2 inch or less in diameter, if grown crowded; or 20 feet high and 2 inches through, if grown in hills. Leaves opposite near the base, and alternate near the top, and composed of 7 to 11 dark green, 2- to 6-inch, roughish leaflets, with notched margins. Stamens and pistils borne in flowers on separate plants.	Height, to 4 or 5 feet. Stout, covered with fine fuzz. Leaves broad, rather thick, dark green above, with slightly incurved margins, to 8 inches long. Young shoots succulent, relatively brittle and rapidly developing into tall stems. Juice milky and profuse. Flower stalks set at an angle to the main supporting stems.
RANGE AND HABITAT	Family Liliaceae. Some 50 species, for the most part native of Africa and Asia, although many are suitable for cultivation in North America and are to be found as house plants, since they survive abuse and lend themselves to limited floor space and exposure to the sun. Named after a Prince of Sansevierio who was born in Naples in 1710.	Family Urticaceae. Related to hemp, hops, and mulberries. Naturalized from Europe where it has enjoyed some cultivation for fiber since the days of the early Egyptians. The common stinging nettle of the North ranges through southern Canada and from North Carolina to Missouri.	Family Urticaceae. A close relative of hops, nettles, mulberries and similar plants. Has been cultivated since the 28th century B.C., when Emperor Shen Nung taught its cultivation in China. It came to the Europeans about 1500 B.C., and to America with the arrival of the earliest pioneers. It was grown primarily for cordage. It does best in rich river-bottoms.	Family Asclepiadaceae. Some 2000 species in the family, found widely distributed over the world. This species erroneously thought to have come from Syria. Native of America, where it is found on rich ground from New Brunswick to Saskatchewan and to the south.
REPRODUCTION	Flowers whitish to yellow, in an open cluster. Tubes swollen at the base, with the 6 stamens attached to the throat. Fruit, a berry, with 1 to 3 seeds. Occasionally, the plant will flower as a house-hold plant, in which case its fragrance is most welcome. Closely related species include the cylindrical leaved <i>S. cylindrica</i> and the flat-leaved <i>S. thyrsiflora</i> .	Flowers clustered in loose formations near the bases of the leaves, greenish, and, in some nettles, staminate or pistillate on one plant or on separate plants. Since the plant will thrive on lands that will support few other crop plants, its culture is relatively simple.	Seeds sown in March more thickly on rich than on poor soil, 35 to 50 pounds per acre, usually in drills. Mature, yellow-stemmed, staminate plants are more abundant than the pistillate, whose stems pale at maturity. Harvesting is possible 4 months after planting. Seed weighs 44 pounds per bushel, and has commercial value. Yield of fiber may reach one ton to acre.	Flowers borne in loose, ball-like clusters, about the size of a baseball, the individual flowers being around 1/2 inch through; white to pinkish, with stamens united below. Pollination by insects, particularly bees, which break parts of the stamens free, carrying them to other flowers. Fruits broadly spindle-shaped, and bursting to free the flat, brown, parachuted seeds.
CULTURE AND ENEMIES	In India, Queensland, Java and South China, the plant is grown for its fiber, which is soft, pliant, silky, very strong, and easily extracted by machines. It is uniformly good through the length of the leaves. A ton of leaves will yield 50 pounds of fiber, with one acre of land yielding 13 1/2 tons of fresh leaves. Propagation is simple and by roots.	The stinging hairs on nettles may cause severe injury. A species in California, <i>U. holoserica</i> , is reputed to have a sting sufficiently severe to kill horses, and the stings of some Asiatic nettles are reputed to be strong enough to kill human beings. As weeds, the plants may be kept in control by cutting twice a year, grubbing with gloved hands or salting.	Hemp fiber is 4 to 8 feet long; gray, if "retted" by dew; and white, if water retted, and is found in flat ribbons made of smaller fibers. The plant requires soils higher in phosphoric acid than corn, wheat, oats or cotton. Retting or rotting is done in fields where plants grew, the process requiring 2 to 10 weeks, then stalks are gathered, stacked and dried.	Grows on wasteland and pasture land or along roadsides, where, in part because of its milky juice, it is avoided by grazing animals. Is the host plant for the monarch butterfly, which hangs its gold-studded, green chrysalids beneath the leaves. Stem survives the winter. Flowers appear June to August. Seeds shed in the fall.
ECONOMIC IMPORTANCE	This plant is known in many homes as "Snake Plant." It is also known as "Murta" or "Moorva." It is probably the commonest potted plant in the hotel lobbies of the United States, and, next to the geranium, ranks high as a house plant. It is most commonly cultivated in the Bahamas, and is slightly more difficult to handle as a commercial crop than is sisal.	In World War I, the fiber was cultivated for making fabrics for tents, wagon covers, clothing. It is capable of producing a good, strong, white linen. A yellow dye is obtainable from the roots and the young shoots boiled make an excellent spinach substitute. In a machine age, it may again become a valuable source of fiber.	Hemp is used in twines, oakum and packing and endures friction, heat and moisture. It dyes blue or violet with an aqueous iodine solution and is high in cellulose. Marijuana comes from the dried leaves, is smoked as tobacco, and is a dangerous habit-forming drug which stimulates unreasonable, and often more or less insane, activities.	Stems produce, in inner bark, a good fiber, which may be twisted into cord or woven into mats. Juice yields some proportion of basic rubber materials and is being experimented with as a rubber substitute source. Down of the seeds is used as insulating material, for filling cheap life preservers, and in art. Young shoots excellent asparagus substitutes.

FLAX <i>Linum usitatissimum</i>	INDIAN HEMP <i>Apocynum cannabinum</i>	MERINO SHEEP <i>Ovis aries</i>	SILKWORM <i>Bombyx mori</i>	NATIVE SILKWORM POLYPHEMUS MOTH <i>Telea polyphemus</i>
Stems, to 40 inches high, and under 1/8 inch in diameter, often divided at or near base into 2 or more nearly equal branches, which themselves remain unbranched until near the top. Leaves narrow, simple, to 1 1/2 inches long. The best fiber comes from long, slender stalks, which are unbranched, and comes from the inner bark of the unbranched portion of the stem.	Height, to 9 feet. Stems relatively slender, branching, wide-spreading. Leaves smooth, or sparingly fuzzy beneath; the lower ones, on short petioles; the upper, without these; darker green above; much longer than wide. Juice, milky, abundant. Underground parts branch profusely near ground surface, sending shoots upward.	Ram weighs about 140 pounds; ewe about 100 pounds. Heavy fold over the body but not on the back. Wool covers the head obscuring the eyes. Ears and muzzle without wool. Skin pink. Neck long. Withers thin. Wool fine, 2 to 3 inches long. This breed raised for quality and quantity of wool. See seventh insert, for Shropshire breed.	Wing-spread about 1 3/4 inches. Wings placed roof-like. Antennae in each sex, broadly feathered. Male cream-colored, with 2 or 3, more or less distinct, brownish lines across the forewings, and half an eyespot on the inner half of the hind wings. Head small and obscured by mat of whitish hairs which extends from front of head to between the wings. Male rarely flies. Female never.	Wing-spread, 5 to 6 inches. Wings held over back. Male fore-wing, buff, olive, or gray-brown, with transparent, yellow-bordered "eyespot"; hind-wing, with dark border, and black eyespot, deeply black-bordered. Female much like male, but with antennae not broadly feathered, and with a heavier body. Night-flying moth, commonly found away from wooded areas.
Family Linaceae, close to the peas. Flax cultivation goes back to the early Egyptians and the earlier Chinese, while a closely-related species, <i>L. perene</i> , was used in Europe in the Stone Age. It is now cultivated throughout Europe except in the Balkans, and in Siberia, China, Japan, Australia, East Africa, Chile, Canada, and the United States.	Family Apocynaceae. Perennial. Closely related to the milkweeds, but has the stamens distinct. Favors relatively poor gravelly soil or sandy areas near streams or waterways. Often, over sand beaches, where it may be low and spreading. Found in various varieties, from British Columbia to California and east to Virginia and Maine. Also in Eurasia.	Order Artiodactyla. Family Bovidae. This breed developed in Spain, nearly 2000 years ago. Introduced into the United States in 1793 and later. Reached peak of popularity 1812 and in the 1860s. Saxon and French Merinos were also imported. Now most popular in England and used to improve other breeds by cross breeding.	Order Lepidoptera. Family Bombycidae. Related to our Cecropia moth. The silkworm has been under domestication in China since 3000 B.C. Later, raised in India; then in Persia; and, about 555 A.D., was introduced into Europe. As a big industry, this was developed in Greece, Italy, France and Spain in about that order. It has never thrived in North America.	Order Lepidoptera. Family Saturniidae. Related to silkworms and tent caterpillars. This species common all over the United States and in northern Mexico. Must be dependent on trees, which constitute its food naturally, even though the adults are active away from the woods. Shade trees of villages and towns often provide ideal environment.
Flaxseed, weighing 56 pounds per bushel, is sowed for fiber 1 1/2 to 2 bushels per acre; for seed, 2 to 3 pecks per acre preferably on clay loam which is fertile. Seed broadcast or drilled and soil is then rolled. Roots too shallow for ordinary cultivation, and weeding is by hand. Harvesting is 75 to 90 days after planting, when seeds are brown and hard.	Flowers small, somewhat bell-shaped to tubular, greenish white, 1/8 inch long, erect, and in loose clusters with those in the center flowering first. Blossoms June to August. Insect-pollination and wind-distribution of the seeds. Fruit slender, curved cylinders, pointed at ends and bursting to free many small, parachuted seeds much smaller than those of milkweed.	One ram, more than a year old, is bred to 35 to 50 ewes at least 1 1/2 years old. In 146 days, ewes bear 1 to 2 lambs. Ewes need 16 square feet of floor space. Lambs nurse in 2 hours, nibble hay at 2 weeks and are marketable at 4 to 6 months. Tails are cut when lambs are 2 weeks old. Castrated rams are known as wethers. All teeth in by 4 years.	About 300 to 400 eggs, resembling turnip seeds, hatch in 8 to 10 days into caterpillars, which, in 6 to 8 weeks, develop, growing from 1/2 inch to 3 inches in length, shedding skin 4 times; usually white-humped behind small head, and with short, rear spine. The 1 1/2-inch cocoon has about 1000 feet of silk, which is cut if moth emerges normally after 2 weeks. Egg to egg, 2 months.	One annual generation arises from female's 300 cream-colored, brown-banded, disk-like eggs, which hatch in 10 to 12 days into caterpillars, which eventually have green bodies, reddish heads, conspicuous body-segments, and when nearly mature, rose-red or pale prickles and silvery tubercles, with 7 oblique, yellow side bands, and red breathing spiracles.
Fineness depends on thickness of stand and uniformity of growth so drought or other weather conditions may affect quality. Fiber flax pulled by hand, an acre being one man's work for a day. Seeds are threshed out. Stems are "retted" in water 10 to 20 days or on the ground 3 to 6 weeks, then wood is broken and fiber is "scutched", baled and marketed.	Fruits remain on through the winter, bursting to free seeds over a long period. The bark, in the green state, or on seasoned plants in winter, yields a good fiber that may be twisted into a strong cord with little difficulty. Host to a beautiful beetle. If the plant were not a weed, it might well be grown as an ornamental.	Food, vegetation cropped close to the ground; best includes clover. Bluegrass pasture does not provide adequate food during warm summer months. Sheep stampede blindly in the face of danger and are killed by dogs. Where there is dog-danger, sheep should be pastured with aggressive breeds of cattle like Angus, which will drive away most dogs.	Food, leaves of mulberry, Osage orange or lettuce. The silk from the silk glands hardens in contact with the air. Pupae in the cocoons are killed by dipping them in hot water, which also softens the gum that binds them. This permits unrolling of the silk and its spinning into thread that has various uses. About 1000 miles of silk in one pound.	Caterpillars may snap jaws hard enough to be heard. They feed on leaves of oak, elm, birch and maple, and make a thick, strong, oval, light to nearly white cocoon, which winters on trees or on ground, and the silk of which can be unwound. There are many parasites of larvae and pupae; birds and bats destroy the adults.
Yield may vary up to 700 pounds fiber per acre. Used in making linen. Flax grown for seed matures in about 100 days. In United States, about 3 million acres yielded about 31 million bushels of flaxseed worth about 58 million dollars, approximately the value of peanuts, barley, potatoes, buckwheat, sugar beets, or grapes. Used as food and for extracted oils.	The bark has been woven into crude mats or twisted into primitive cordage. The underground parts provide a superior anchorage for loose sands and gravels on beaches, along streams, or on steep banks where sufficient water is available. Juice now being experimented with as a source of rubber.	A ram's pelt weighs to 30 pounds; an ewe's, to 20 pounds. They yield a fiber that is spun into cloth that is durable, warm and attractive in appearance. The intestines of sheep, particularly of lambs, yield a high-quality gut of value in surgery, in the production of musical strings, in tennis racket strings, and in other ways.	Silk supports great industries throughout the world, but depends basically on availability of abundant cheap labor for initial steps. In a new order, it may be supplanted by synthetic materials produced by the chemists, and this may have far-reaching social significance particularly in the Orient. Silk is used in fabrics for parachutes, clothing, balloons, etc.	Excellent fishing "leaders" may be made by pickling mature larvae in saturated solution of salt and vinegar, cutting larvae to let solution enter, then drawing silk glands out with pins and allowing them to dry in the air, suspended from some support. These gut leaders are longer and better than those from the commercial silkworm whose silk glands are smaller.

(Continued from page 419) quires splitting of the stem and then bending the halves outward so that the fractured hard material does not cut the more delicate fiber.

In some cases, the fibers may be released more quickly if the tissue is boiled in a weak lye solution. This may be made by boiling wood ashes for about ten minutes in water.

Some of the most effective binding material comes from animals. The hair, hide, sinews and glandular secretions of a great variety of animals figure in this and their treatment varies as greatly as do the sources.

Rawhide rope has long made a name for itself. For some uses, no satisfactory substitute seems available. We still use it for the webs of snow shoes, for shoelaces that must stand special usage, for harness and for other purposes. Rawhide has the disadvantage of varying greatly in length with the amount of water in it, shrinking when dry. To prevent this, the hide is waterproofed with oils, greases and other substances.

If you happen to have a spare piece of leather that is soft and flexible, or a hide that has been reasonably well cured, you can make a leather thong relatively easily. Cut from your leather a circle as large as possible. Now, begin cutting from the outer circumference a piece of leather as wide as the thong you wish. Continue in this way to the inner part of the circle and you will have a continuous thong.

In the packing industry, strings for musical instruments and for tennis rackets are made from intestines. The best of this material comes from the small intestines of lambs, where about twenty-four feet are suitable for a superior product. It requires this portion of the intestines of eleven lambs to string a tennis racket. Those who have occasion to handle carcasses, and who are seeking material for tying things should not overlook the intestines of the animals as a source of supply. A tennis string must stand a strain of one hundred pounds to come up to the standard set.

Most fishermen have noticed that the average "gut" leader is made of a number of sections tied together. For the most part, these sections have been made from the silk glands of the commercial silkworm. Much longer gut leaders may be made in one piece from the native silkworms, which are to be found wild in most parts of our own United States. Among these moths are the cecropia, luna, promethea and polyphemus. Anyone can make an excellent gut leader from the caterpillars of these moths. Any good entomology will show pictures of these caterpillars, or they may be had from a twenty-five-cent bulletin called *The Moth Number*, published by the Slingerland-Comstock Company of Ithaca, New York.

When these caterpillars cease eating and begin to wander about preparatory to making their cocoons, they are ready to be used in the making of gut leaders. They are killed by immersing them in a saturated solution of salt and vinegar. To be sure that the killing solution enters the body of the caterpillars, shallow slits are made in the side of the body. In a day or so after the caterpillars have been killed in this way, they should be opened carefully. The two silk glands will appear plainly as silvery bodies. If a needle is thrust into one end of a gland and another needle into the other end, the glands may be drawn out through the solution and if this is done steadily and carefully the resulting gut will be uniform in diameter. A single caterpillar has two silk glands so may produce four of these leaders. If one needle

is thrust in a support high enough to hold the other needle off the floor, and the glands left hanging, they will lengthen somewhat and will become most slender at the upper end. After a few hours it would be well to reverse the two needles, and a few hours later reverse them again. In this way a long, spindle-shaped gut will develop, which, of course, will be thickest in the middle. If the gut is cut in two in the middle, you will have two perfectly-tapered gut leaders that may be four or five feet long.

The story of the silkworm has been told so many times that we will merely summarize it in the chart section. But the animal service must be recognized in peace or war. However, rayon, nylon and similar developments are, no doubt, only the first steps toward synthetic fibers or fabrics of superior quality, the social implication of which, centering around the products of the silk glands of one insect, staggers the imagination.

Animals that have long-haired tails can provide materials for reasonably satisfactory ropes or cords. Several short-haired animals produce in their pelts excellent wool, which may be spun into yarn and woven or twisted to form fabrics or cordage. These fibers are usually reserved for the making of blankets or clothing, their value lying in their beauty and warmth rather than in their strength and flexibility.

Primitive folk the world over have found in animal sinew a material that has wide uses. The better of these sinews are those of the backs of the larger animals. When these have been soaked, they are split into finer portions—some as fine as thread—which, twisted, provide a strong slender string for beads, bead-work, or sewing moccasins or garments.

Having suitable fibers with which to work, you may so combine them that they may make a cord with maximum strength and a minimum of diameter and weight.

Take a mass of fiber such as you can get from milkweed, nettle, hemp or flax. Make a rough cord somewhat larger than you wish your final cord or rope to be. Loop this over a stub of a tree or a nail, holding the opposite ends in your two hands. It may be more convenient for two to work on the job at the same time, in which case each person will work on one of the free ends. Give each end one or more twists in the direction taken by the hands of a clock. After each complete twist, shift the right hand end over the left one. If you wish a tighter-twisted cord, give it two twists, or more, before shifting the ends, but if you want a uniform bit of cordage always continue to give the same number of twists before a shift is made. New fiber may be added at the loose ends so that a uniform amount is constantly twisted into the rope or cord.

Rushes may be twisted into loose ropes for making mats or for providing seats for chairs. Once they are in place, they should be shellacked or varnished, and to give long service should be regularly varnished to avoid wear and general deterioration.

There is a rich literature on the making of baskets, mats, rugs and fabrics. One thing is certain, however, and this is that in spite of what the war may do to the silk, manila, sisal and rubber that we had come to accept as necessary to our way of life, the present emergency may prove to us that we can get along without them. We have the raw materials and the ingenuity. Should it develop that, when the war is over, we no longer need much that we imported, the aggressor nations may find that they made a grave mistake when they started puffing out their chests and talking of writing a peace of their own choosing in Washington.

As We See It

Migratory Game Bird Rules

Little change is made in the regulations governing the shooting of migratory game birds for 1943. The seventy-day season on migratory waterfowl in each of three zones is continued—this, of course, subjecting a considerable proportion of the migratory birds to 109 days shooting—and the shooting day is lengthened by allowing shooting to start half an hour before sunrise. Bag limits and possession limits remain the same, and the use of live decoys and shooting over baited waters are still prohibited.

Regulations governing the taking of woodcock and white-winged and mourning doves remain virtually the same as in 1942. Closed seasons on snow geese in three Montana counties and in Idaho are continued to protect the remnant of trumpeter swans.

We are not disposed to quarrel with the waterfowl regulations this year, for the first time in some years. Not that we feel that several species have recovered sufficiently to warrant heavy drain on their numbers, but because we feel that circumstances generally will conspire against heavy shooting. Transportation difficulties and dearth of ammunition this year should definitely relieve hunting pressure. The average duck hunter may be expected to use his shells with a discretion consistent with their rarity. It is hoped, also, that he will concentrate on the more abundant species such as mallards and pintails.

Although it was too much to expect, we would have liked to see closed seasons on woodcock and white-winged and mourning doves. Generally in none too great numbers, these birds have little significance as a source of supplementary food. They are shot purely as targets and for the "sport" of it, and therefore it seems to be a waste of rare ammunition to pull trigger on them. We trust that many hunters will feel this way about it, and that the birds will get a break born of circumstance if not solicitude.

As the duck-hunting season gets under way we may see more emphasis placed on the importance of harvesting migratory waterfowl as food. Actually, of course, any concerted effort in that direction, even if stocks of ammunition and gasoline permitted, would be an expensive and uneconomic way of adding to the meat supply. Waterfowl may eke out the larders of the hunters and some of their friends, but they can at best provide only a passing variation of diet. Proved surpluses of our game birds and mammals should, of course, be harvested, particularly where the range or feeding grounds are inadequate to provide for the numbers using them. But game birds and mammals should not be considered on the same basis as domestic fowl and meat, or any slightest trend toward commercialization permitted.

Jackson Hole—Fact and Fiction

Just why there has been so much fuss about the presidential proclamation creating the Jackson Hole National Monument is not entirely clear. One would gather from the furor that has been raised that the whole State of Wyoming was going to be ruined, and that its citizens were so incensed that they were about to move on the White House *en masse* in protest. Pending legislation seeks to rescind the President's proclamation, to prohibit him from proclaiming other National Monuments, and to cut off funds for administering the area already set aside.

Newspaper correspondents and columnists, unhampered by facts, have built the whole business in a "burning issue." They have pictured dispossessed landowners, starving cattle and ranchers and great loss of revenue to the State. While we are not in favor of adding areas to the National Park and Monument system unless these areas are up to a high standard of value, the record on Jackson Hole needs to be kept straight.

Fifteen years ago John D. Rockefeller, Jr., purchased 33,000 acres to be given to the Federal Government in connection with creating a scenic and recreational area. He has been paying nine thousand dollars in taxes annually on this land ever since, and this represents about all the tax loss Wyoming would suffer. Of the total 221,000 acres involved in the Monument, seventy-six percent is already Federal land, administered by government agencies, principally the Forest Service and the General Land Office. Slightly less than eight percent is in private or State ownership. And to any such lands all valid existing rights continue during the lives of the owners and those of their immediate family. Grazing, cottage and other leases and permits are not affected.

Thus no one is being harmed, and such minor tax loss as the State might suffer should be far more than offset by the revenue that would be derived directly and indirectly by the establishment of a recreational area. For our part we are quite indifferent about this National Monument. Irrigation development that already exists in the area, and the present commercial uses that will be perpetuated, make it, in our estimation, a below-standard addition to the National Park Service holdings. We do not believe that the Service is adding to its stature by taking such tracts under its wing. In other words, we are not particularly concerned about the fate of this National Monument, but we regard as dangerous any malicious and distorted attacks—such as the present one—that involve any phase of the conservation program. True and dispassionate consideration of all the facts involved should be allowed to provide the decision.

Nature in Print

By HOWARD ZAHNISER

A PROFESSOR of divinity in the University of Cambridge, England, whose first-hand study of Nature for many years gave him, as he says, "health and ability for hard work" has more recently been following such pursuits vicariously in writing of the life and works of the Seventeenth Century naturalist John Ray. The resulting biography, now published in this country by The Macmillan Company, is a volume not only informative regarding an outstanding genius in botany and zoology but also significant in suggesting the origins of both modern science and the now-common resort to the outdoors for inspirational recreation.

"As a theologian," says the author, the Rev. Charles E. Raven, D. D., "my primary task long ago convinced me of the importance of the change in man's esthetic, moral, and religious outlook which had accompanied and in large measure inspired the scientific movement. It was plain to me as a parson that the mixed folk whom I met as an entomologist and bird-watcher had found an interest in nature which was singularly rich in educative and recreational value. . . . Experience affirmed that though the great poets and artists had seldom lacked it, its widespread influence was comparatively modern."

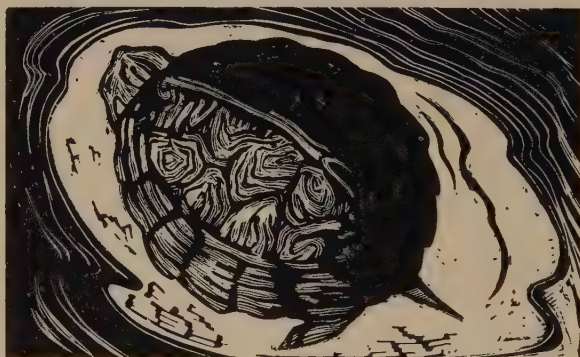
Tracing the beginnings of this widespread influence back into the Seventeenth Century, Dr. Raven has centered his attention on John Ray as an eminent pioneer in the change that thus took place "from the old world of superstition." It is a theme that lends the excitement of an idea to the definitive and painstaking record of a scientist's life and works—a record based on "meticulously collating every record of his travel and research." Only by setting out these details could the greatness of Ray's work be established, says Dr. Raven, and most of the book's readers, duly impressed, will be ready to exclaim with the scholarly Sampson in Sir Walter Scott's *Guy Mannering*: "Pro-dig-i-ous!"

Spoiled perhaps by too many easily read biographies, these readers may at first be dismayed by the volume's proportions. Deprived of the intimacies to which many biographers invite them, they may consider the book lacking in human warmth. As the author himself says, "the man who after eleven years of married life could announce his fatherhood to his

best friend in an apology for the slow progress of his work: 'I have also been a little disturbed and interrupted by the indisposition of my wife who was yesterday delivered of two children at a birth, both females,' is not a promising subject for intimate biography."

Yet here in this volume are at least the data for excitement, the materials for the imagination. The author makes no specious resort to "creative" writing in reporting his findings about John Ray, but it is obvious that he has carried on his self-appointed, objective task with no little warmth for his subject, and in his preface he does phrase the subjective impressions of a reader who has surveyed the whole:

"Behind the vast and varied achievements of one who laid the foundation of the modern outlook upon Nature lay a fascinating and heroic personality. The blacksmith's son who in an age of almost feudal class-consciousness won for himself reverence and friendship and that without sycophancy or aggressiveness; the fellow of Trinity who when consciences were elastic gave up everything sooner than declare that the Covenant which he had not subscribed was no oath; the explorer who 'trusting in Providence and good friends' toured Western Europe for its plants and birds, fishes and fossils, and traveled Britain so thoroughly that he could supply at first hand a list of the rarer plants for every English county; the writer who in the last twenty years of his life, straitened in means and racked with pain, produced some fifteen new books, including the 3000 folio pages of the *History of Plants*, the *Synopses* of animals, reptiles, birds and fishes, the first serious treatise on science and



religion, and in addition some nine revised editions of these and earlier works; the naturalist who in the last decade of the century with the help of his four little daughters bred and described the life cycle of nearly three hundred local lepidoptera; could anyone with powers of admiration and interests in natural history resist so intriguing a subject?"

Great, however, as were Ray's pioneer contributions to the knowledge of plants, birds, mammals, fishes, reptiles, insects, and fossils, his most popular and influential achievement, according to Dr. Raven, is his interpretive book, *The Wisdom of God Manifested in the Works of Creation*. A good case, says his biographer, could be made for assigning to this book a primary place in the development of modern science, for in it John Ray made a beginning in a scientific and philosophical explanation of organic life. "The book is packed with references to and discussions of problems, ranging from the nature of atoms or the influence of (Continued on page 442)



Indians and Conservation

By JOHN WINTERS FLEMING



The Indian warrior, slain in battle, lies among the animals that have come to give of themselves to restore him to life. This and the other two pictures that illustrate this article are from paintings by Sanford Plummer in the Local Indian Alcove, Hall of the Niagara Frontier, of the Buffalo Museum of Science.



CONTRARY to the popular notion, the original American, the Indian, was not wantonly and ruthlessly destructive of the flora and fauna of his native land. Rather, history shows that, as a general proposition, he was the original American conservationist.

Proof of this is to be found in the lovely legends of the Seneca Nation, Keepers of the Western Door of the Longhouse, the Iroquois Confederacy or Six

Nations. This was a strong and wise organization.

Seneca children were taught never to pluck plants or slay animals unless they had a use for them. The Indian hunted and fished, not for sport, but for food. Never did the Seneca pick the first plant he found, or kill the first game he met. Instead, he performed a ritual, believing that the ceremony would bring happier hunting later on.

The spirit of greed will engulf the greedy one, the



Indians were not wasteful of the natural products upon which their very lives depended. They used what they needed but made sure that plenty was left to provide for the dire needs that might arise another season.

Senecas taught. If the fisherman caught for himself more fish than he could use, the watery hand of the spirit of greed would consume him.

Indeed, the Senecas taught their children that their very world came to being only through the good offices of the animal realm. In the beginning, a Seneca legend has it, there were two worlds, an upper and a lower. Men-beings lived in the upper world; water animals in the lower. In the upper world there grew a tree from the fruit of which the men-beings lived. In a rage, one day, the chief commanded that this tree be uprooted.

The uprooting left a large gaping hole in the thin crust of the upper world. Through this hole the chief peered down upon the lower world. Calling to his wife to come and look, the chief again became enraged because, as she stood staring down through the hole, she did not answer when he spoke to her. So he pushed his wife over the edge and down through the hole. As she fell she grasped some of the seeds and roots of the tree. The aquatic animals of the lower

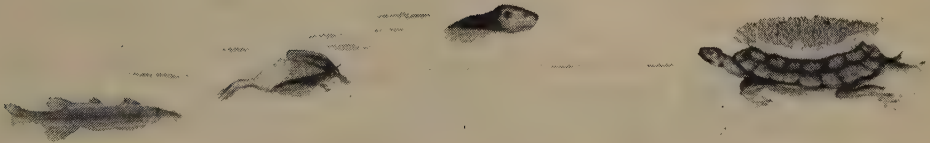
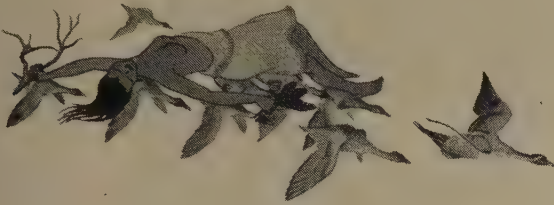
world saved her from destruction. The ducks caught her on their wings and placed her gently on the turtle's back. From the bottom of the watery lower world the muskrat brought a bit of earth, which became an island on which she lived. On this island she planted the seeds of the tree of life and thus secured sustenance for the new earth.

The origin of their most potent and most secret medicine, the Little Water Medicine, is rooted beautifully in the animal kingdom's love of man, according to another lyric Seneca legend. The animal kingdom came upon a great Seneca warrior slain in battle—his scalp drying in the smoke of the enemy's campfire—and befriended him who in life had befriended them.

To concoct a remedy to bring him back to life, various animals gave parts of their bodies, and some gave their very lives. The sparrow hawk brought back the warrior's scalp. The dew eagle moistened and softened the scalp with the dew that he always carried in the hollow of his back. Thus the scalp again



The Seneca idea of the beginning of the world and its people. Angry, a chief pushed his wife through the hole in the crust of the upper world. Ducks caught her on their wings and brought her gently to the lower world.



was fastened to the hero's head. Finally the bear gave the warrior a great, warming, revitalizing bear-hug and the hero miraculously lived again.

Compounding the Little Water Medicine was a Seneca secret guarded with religious fervor. In each

tribe only one man knew the secret, and, when he realized his death was near, he passed it on to a successor. The medicine was always kept in the close custody of a secret society, and, to preserve its potency, rituals connected with it were enacted each year.



A Season's Gift

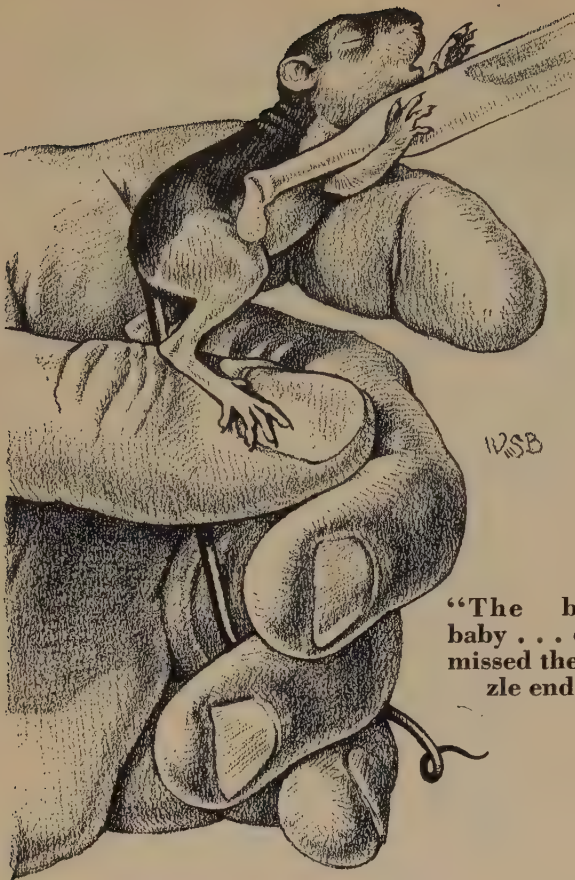
By PHILIP MENARD

Here's a word to one who grieves
On this Autumnal day:
Go view the sunlight in the leaves,
For, truly, they are gay!

A Short Mouse Tale of Long-tailed Mice

By WILFRID S. BRONSON

With illustrations by the Author



"The blind baby . . . often missed the nozzle end."

THIS mouse tale is short. But it is about three mice whose tails were very long. And they had also long hind legs, as oversized looking as those of kangaroos. Yet they were not kangaroo mice, such as live in the dry Southwest. They were jumping mice, a kind that lives in many sorts of country from Alaska to the Carolinas.

These three jumping mice were born in the Cats-kill Mountains, in the garden of my neighbor. Their mother had made a mistake. Finding a potato hill an easy place to dig, she burrowed into it, hollowed out a room among the growing potatoes, filled it with soft

grasses, and had her babies there. Although they were still too young to have their eyes open when found, the kind lady forbore to cut off their tails with a carving knife, unlike the farmer's wife in the song. Perhaps it was simpler to give them to me. Could I possibly keep them alive until they were able to care for themselves? Doubtfully I decided to try.

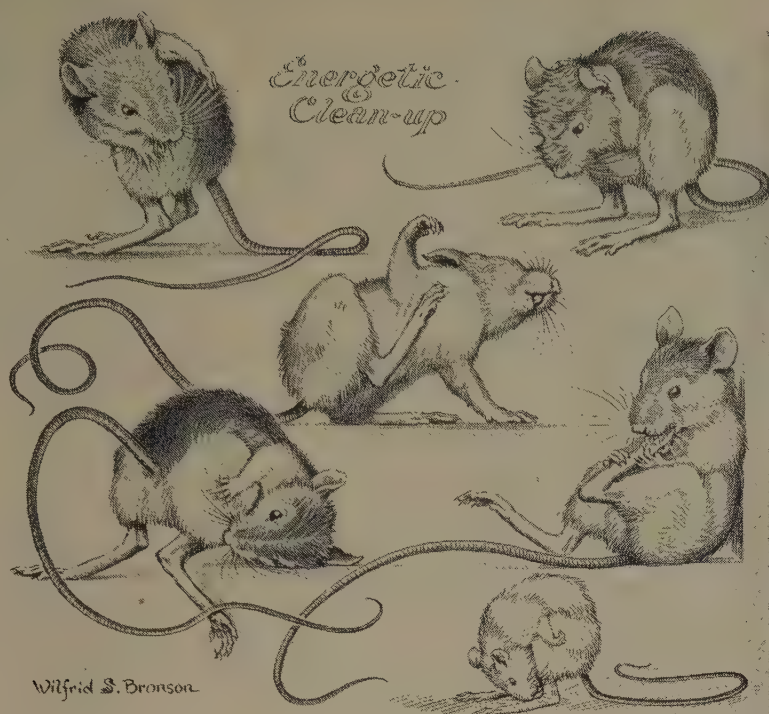
Think how mother mouse must have held her breath at first when the monstrous neighbor man came cultivating with his hoe! But he always passed on down the row, and she only had to push away the loose dirt he had scraped into her doorway. He never even saw that mouse-hole under the potato plant's green leaves. As days went by she got used to the tramp of his feet and the scratch of his hoe. She felt secure by day and had nothing to fear from him at night, when she went out to feed on seeds and berries.

Actually things were not working out as well as she supposed, for the potatoes were ready to leave the hill much sooner than her babies were. So one mid-September harvest day when the man dragged his hook through the hill, out rolled three baby mice along with five potatoes.

The mother mouse, rushing out as the hook came into the hill, escaped unseen and probably took a few babies with her. If any were nursing at the time they went right along. Still holding fast with mouth and paws amongst her fur, they had a fast ride among the



Eating from the typewriter box feeding dish and from a cracker smeared with the specially-prepared paste.



potato plants still standing, to some new hide-away where another nest could be set up, however hastily.

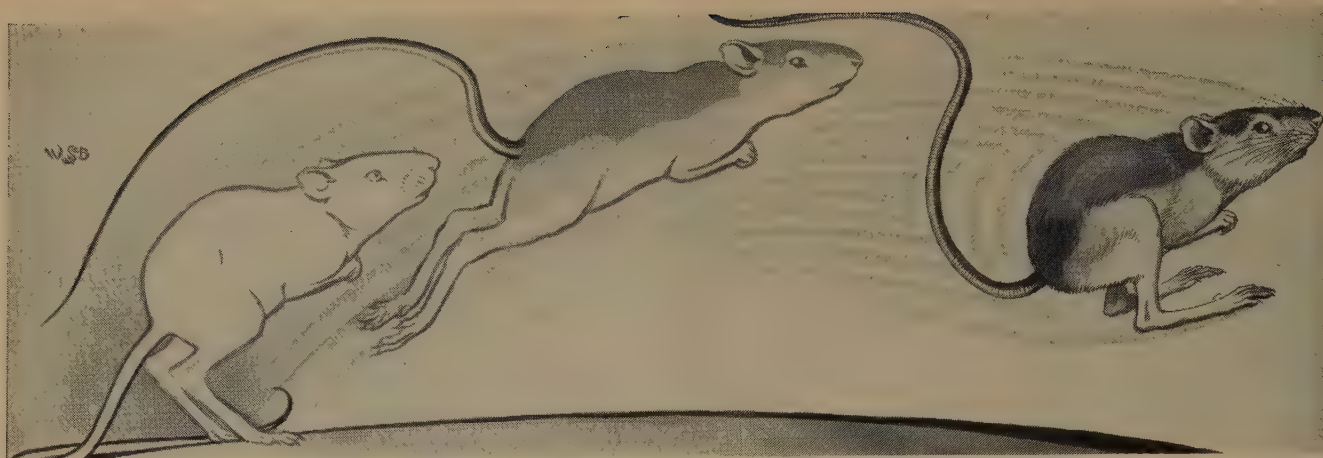
The old nest was a ruin, and soon the harvesting hook had opened every hill in the patch. Through all that havoc it was doubtful if the mother would come back looking for the three babies she had left behind. One of my neighbor's garden patrol of cats would surely find them first. Thus I, whose only pets live in the woods and fields, became their foster-father.

I knew it would not be easy to feed infants only one inch long. Plain cow's milk would be too heavy for their tiny stomachs. So I added a little water and a touch of honey and warmed it slightly. As I took each baby up in turn, his tail, twice as long himself, became most useful. It acted as his anchor chain, its end held between my ring and little finger. It was long enough to let him rest on the back of my thumb against the other fingers. But "rest" is not the word. The poor little creature would try to scramble about, pushing his nose between my fingers and into creases in my half-closed hand, hoping to find his mother, I suppose.

Although a medicine dropper nozzle is so small, it was still too large for their minute mouths. However, it was better than the rag soaked in milk that I tried at first to make them suck. This soon had their white

bellies, yellow sides, and even some of their brown backs, soaking wet. Still, the dropper was messy too, often missing its mark. The blind baby, not understanding the dropper at all, but realizing there was milk to be had, often missed the nozzle end. He would push along the hard glass tube with both hands, seeking the soft fur of his mother. Little pressing motions of his hands always went with getting his dinner. With nothing to press against, and only a clumsy tube to suckle from, he was confused. The first time around Number One would get almost nothing. I would put him into a strawberry box lined with Turkish toweling to "think it over" and blot away some of the spilled milk from his fur. Numbers Two and Three would follow, faring about as badly. But the second time around they generally were so eager to try again that we would have a little more success. It might be necessary to do this four or five times before they were full and ready to sleep some more. This chore often took an hour, sometimes more. But it had to be done every three hours every day, the last time close to midnight.

After a few days all three had learned to lap drops from the dropper as I slowly pressed the rubber bulb. But they would stop lapping or wiggle about so unexpectedly that it was not long before they were fairly varnished with milk and honey that dried on



their fur. Therefore every other day they simply had to have a bath. Slowly, one at a time, I would lower them into a basin of lukewarm water containing a little soda. Each lay perfectly still on my hand as he sank to his ears and I rubbed him with one finger. They seemed to enjoy the warmth of the water, which held them closely all around.

After the bath they basked in the warmth from my goose-neck lamp—like beach bathers tanning in the sun—turning first one side and then the other. They would wash their faces while their bodies dried off, although still unable to see what they were doing. It seemed to take a long time for them to dry entirely before they could be put to bed in their flannel and shredded-paper nest—especially long at half-past one in the morning.

This unending task was proving tiring and was interfering with my work. Tending three elephants would have been much easier, but there was no giving up once we had started. These three blind mice may have been my patients, but I was certainly their prisoner, from early morning till late at night. Yet even though I kept at it for many days they were not feeding often enough for such small babies. And there were those long spells between midnight and morning when I was asleep and they could get no milk at all. Although they seemed to grow some and actually got their eyes open, they grew thinner and thinner. Soon I could count every bone in their long slender tails like beads on a string.

When they tried to creep about, the hocks of their long hind legs knocked together with weakness. When sitting up, propped by their tails *à la* kangaroo, they frequently fell over sideways. They were pitiful indeed. For all my care they were starving right before my eyes. The only milk diet I could fix for them was not half good enough. Yet they were much too young to be weaned. They had no teeth to eat solid food, even if their stomachs could stand it. I could think of only one thing to do; to make a soft paste that they could suck and swallow if they would. I mixed butter, soft-boiled egg, the tiniest bread

crumbs, and scrapings from the sweet inner side of blue grape skins. And I added a drop or two of mineral oil just to help their infant insides with the adult food. Would they eat the paste? Could they digest it? Could these little waifs, whose hoped-for future was a life of jumping, clear the gap between infancy and adulthood in one great death-defying leap? There was just this one slim chance!

I plastered the paste on a cracker and put a typewriter ribbon box-cover full of milk nearby with bread crumbs soaking in it for a drinking fountain. By the several ways they took to that new food they earned their special names. From then on I called them Doubtful, Hopeful, and Sure.

Doubtful sniffed the paste, wobbled away to the drinking fountain and went to sucking milk from a soaked bread crumb. Hopeful did this too but went back to the paste. He got some into his mouth, chewed it with toothless gums, and swallowed. It seemed to go down hard. Sure sat down before the paste and gummed and swallowed for a full half hour. He would pause after swallowing until each lump settled in his stomach. While waiting he would doze, start falling over, suddenly brace up, and get at the food again.

That night Sure and Hopeful must have gotten out of bed and helped themselves again and again. For much of the paste was gone in the morning. But Doubtful had toppled into the bread and milk. He must have crawled out finally to lie on the cold cage floor most of the night. He seemed about dead, as dreary a sight as a restaurant tea-bag when lifted from the cup. But a hot bath and the lamp's heat helped a lot. After that I kept a little glass jar of milk inverted in the pan of soaking crumbs. Raised the thickness of a hairpin, it let milk down as needed, but prevented any more cold milk baths.

Of course, Sure and Hopeful drank from the milk pan too. The respective methods of my three little problems continued to justify their names. Doubtful had first sunk his nose in the milk and come up wheezing. He finally found that he could lift out a

wet crumb, hold it in his hands and suck it. Hopeful would dip a hand into the milk, cup his other hand under it, and lap from them. Sure lapped directly from the pan.

It reminded me of the choice of men for Gideon's battle with the Midianites. What significance the device for choosing may have had, I have never figured out. The three hundred who lifted water to their mouths in their hands went to the attack, you may remember. Those who drank directly from the stream remained in camp. And there developed something more in this parallel of mice and men, as you shall see in a moment.

I found that Doubtful would eat plain butter, although still ignoring the paste. He seemed to recover from his near drowning and to be in very good spirits for several days. Once he looked brightly out of the nest and said, "Tuke!" Later he trilled prettily. The other two never uttered a sound. Although Doubtful was weak and finicky, perhaps he would grow up and sing, for some mice do. But alas, no. One morning I found his frail body under the little cardboard stairs in the cage. He had jumped across the Great Divide.

During the days that followed, Hopeful and Sure seemed to double in size. They grew fat and frolicsome, and soon were almost three inches long; their tails five. They scratched and washed themselves with vigor, and luxuriously stretched ever-healthier muscles. But because of the ordeal they had been



through, all their fur fell off, leaving them stark naked. One evening as I reached in to clean the cage, Hopeful got out, crossed the study floor in six-foot jumps, and went behind some drawing boards and boxes. Although I turned the study almost upside down, I could not find him. I left food on the floor night after night but he never came to get it. He must have found some hidden crack and gotten clear away. What may have happened to him out in the frosty night with not a hair

to his hide? Did he freeze, or does some owl know all about it? At any rate the little hand drinker, like the chosen men of Gideon, was gone on a wild campaign. Sure, the drinker direct, remained behind. Sure grew a new coat rapidly, and teeth. Two sharp chisels showed in the cleft of his upper lip. He tried them on everything, starting with the hard rye cracker under the paste, going on to wood, and once even nipping my thumb as I lifted him out of the nest to shake it up a bit.

One fine Indian summer day I took the cage to a place at the edge of the woods where a clay bank was exposed. Already other jumping mice had dug their winter sleeping quarters there. I left the cage door open. That night Sure went forth into the world, as ready to make a good life of it as I could prepare him. Three fine days followed, time enough for him to burrow into the bank, make his nest, and roll up with comfort, to sleep till spring. Sure? I hope.



Survival of the Fittest

By PAUL CHURCHER

When the sun from the sky has faded
And at mid-day starlight shines,
When our seas are gone, or frozen,
And ice from the poles inclines,
When the World is a World of silence,
And Man's history is fulfilled,
With civilization crumbled
And Science and Progress stilled . . .
THEN on the rocks of the tropics
Beneath the eternal snows
Deep in a frozen crevice
Where a bit of lichen grows,
Shall be seated a tiny object,
Patient, complacent, snug;
Our Era's sole survivor:
A melancholy bug.



"... they are hunted as they march by night, or while they rest by day."

The Nazis are not the only rodents to infest Norway, for there are also—

The Prolific Lemming

Illustrated by R. Bruce Horsfall

By PAUL BULLA

HIGH on the mountain slopes and plateaus of harassed and enslaved Norway, a shy little rodent called the lemming lives quietly and obscurely beneath tufts of heather or decayed stumps of trees. Up to and beyond the snow-line this animal is present in large numbers. But it is seldom seen, for it remains hidden by day and ventures forth to feed only between the hours of dusk and dawn.

In appearance the lemming resembles a miniature guinea-pig. It is related to the European voles and meadow-mice, and is known to scientists as *Lemmus lemmus*. Its extraordinary migratory habits in its years of abundance have set it apart from all others of its relatives and made it a dreaded scourge to the inhabitants of Scandinavia's lowland country. To them its name is synonymous with disaster, for devastation and pestilence are its companions wherever it appears beyond its natural habitat.

Were it not for the changes that occur in its nature and way of life in what are known as "lemming years," its activities would be of little economic interest, for its mental powers are extremely low and its benefits to man are negligible. But its habits when Nature favors its increase have given it a prominence out of all proportion to its size and biological importance.

This little mammal is the largest of the Arctic mouse-like rodents. It has a thick-set body, some four or five inches long. It possesses a short, stumpy tail and moves with an energetic, bustling gait. Its fur is a brilliant yellowish-brown with a dark base, except for the top of the head and the withers, which are a jet black. This black patch runs from the upper

part of the bluntly-rounded muzzle, and along the lower borders of the bead-like eyes, to the tiny ears hidden in the thick coat. From this point it continues and saddles the shoulders, after which it narrows to the spine and extends to the rump as a narrow dorsal stripe. Related species are found in the Arctic and Alpine sections of North America, but because of the greater extent of range enjoyed by the American species, and their remoteness from populous settlements, their migrations are less spectacular.

Fossil remains of the European lemming have been uncovered in formations of the post-Pliocene or glacial period in Saxony, the British Isles, and as far south as Portugal, but the species was first mentioned in a Thirteenth Century translation of the Plagues of Egypt as recorded in the Bible. In this manuscript the translator draws a comparison between the lemmings and the locusts that visited Pharaoh's lands, because the former were believed by the ancients to descend from the clouds in swarms. Their widespread depredations were regarded so seriously in early times that prayers of exorcizement were read by the clergy to bring about their departure from regions they had overrun.

Lemmings are found throughout Swedish and Russian Lapland, and also in Finland, but their best-known breeding grounds are the exposed and barren heights of the five great mountain groups of Norway. There, above the zone of coniferous trees or in the low-willow or dwarf-birch regions, they hide in burrows from the sight of man. Their diet consists chiefly of grass, moss and the bark of such shrubs as are to be found in that harsh and inhospitable climate.

“ . . . they will plunge without hesitation into lakes or rivers too broad or swift for them to cross, and strike out boldly for a shore-line they cannot see . . . and their hopeless plunge into the sea at land's end still carries an air of mystery.”



In nests built of loosely-assembled grass or bark, the young are born—blind and without hair. Some time between the eleventh and fifteenth day after birth, when they are about the size of the common mouse, their eyes open. From then on they are extremely active and self-reliant. As a rule the young produced each year number from four to six individuals, but in “lemming” years three, and often four litters of from five to eight, and even ten young are born to a pair in the course of a summer. In such prolific periods it is not uncommon for a litter to arrive in a nest still occupied by the previous litter of young. Despite such unfavorable conditions, individuals produced in lemming years appear to be more vigorous than those born in normal times.

While overproduction occurs in certain areas of the Peninsula each year, and minor migrations follow as a matter of course, the damage to crops and vegetation in the valleys is small. It is only when an excessive number of individuals are produced in successive years and in several sections that there is danger of a mass exodus. When hordes of these creatures desert their home territory and join the march of multitudes from other regions, a dreaded lemming year has arrived in the lowlands.

Such invasions have occurred at intervals of from five to twenty or more years down through the centuries, and records show they have been felt more severely in the fertile valleys of Norway than in the forested areas of Sweden. At such times few if any lowland regions are to be found on the Norwegian mainland that have not at some time been visited by lemming hordes, but seldom has it happened that an incursion has embraced the entire lowland countryside.

These migrations take place in the autumn, and while many adults accompany the marching hordes, many choose to remain in their mountain retreats.

The restless host that spills into the plains is chiefly composed of young lemmings only a few months old. In their mountain home each individual normally has a large tract of land from which to obtain food. When this living space is overrun by ravenous multitudes, those on the outer limits of the home territory move down the mountain side in search of food. These adventurers are followed by others, and as grasses, mosses and lichens become more abundant the farther they move away from the snow-line their fecundity increases, and the exodus becomes a destructive calamity to the countryside they traverse. During these invasions field crops are devoured, gardens are ravaged, while meadows and pasture lands are stripped of all vegetation. These rodent pests literally eat their way to the sea.

At this time their dispositions also undergo a metamorphosis. Although the creatures are timid and harmless in their mountain retreats, these traits have vanished by the time they arrive in the lowlands. Along the way they have overcome fear and the sense of danger and boldly enter the streets of towns, and even houses, that lie in their pathway to their goal in the west. Not only have they become churlish and irascible, but they now shun the society of their own kind, while traveling in the same general direction. On meeting face to face they bark at each other, and when the paths of two old males cross a fight to the death often takes place. Even a slight wound proves fatal to these small creatures in spite of the fact that they are able to withstand incredible privations in order to exist. The instinct of self-preservation has also become submerged by the force that drives them onward. Instead of remaining concealed when enemies are nearby, they draw attention to themselves by sitting upright and hopping excitedly about, while making a hissing noise or uttering their strange barking cry. They may even attempt to defend themselves

against the hunter who approaches them. In their rage they have been known to sink their teeth into boot or stick advanced toward them, and hold on tenaciously while being lifted high off the ground.

Impelled by a blind and irresistible urge, they try to surmount all obstacles that impede their progress. This force, which drives them into dangers they seem unable to avoid, often causes them to march heedlessly out into space, or to fall into wells or excavations from which they cannot escape. During their normal life in the mountains lemmings avoid water hazards whenever possible. When migrations are under way, however, they will plunge without hesitation into lakes or rivers too broad or swift for them to cross, and strike out boldly for a shore-line they cannot see.

Even the ocean does not stop them for when they reach the coast and can proceed no farther westward by land, they crowd into the water and swim straight out until they reach some island refuge or drown from exhaustion. Although lemmings swim high out of the water, their range of vision is limited as their eyes are set on top of the head. This prevents them from seeing objects not well above the horizon, and may account in some measure for their venturesome attempt to cross the ocean.

All migrating lemmings die in exile, none ever returning to their mountain home. It is indeed surprising that they continue to survive as a species, considering the number of enemies they encounter along the way. As they move through the valleys vast numbers are slaughtered by the inhabitants of the regions through which they pass, while predatory animals and birds of prey follow the march and account for other multitudes. But even under these conditions their numbers increase as they proceed on their way. Forming the staple food of the Arctic fox, the snowy owl, the rough-legged hawk, and many other animals and birds that flock to the feast, they are hunted as they march by night or sought out while they rest by day.

On their appearance near villages and towns, cows and goats trample and even devour them, while dogs and cats become exhausted from killing them, and so surfeited with their flesh that they refuse to eat them. In the Arctic regions of the Peninsula, both tame and wild reindeer relish them as food. Fish, particularly pike and trout, when examined, have been found to contain the bodies of these little creatures.

As lemmings do not hibernate or lay up stores of food against the winter months, great numbers die of starvation when deep snows cover the land. Rough and damp weather is also injurious and often fatal to them. Following stormy periods of wind and rain occurring during an exodus, their bodies are found heaped in ditches and clogging sewers. But of all the agents that work unceasingly to destroy them at home and abroad, the most active and insidious appears to be a form of tularemia, which invariably attacks them some time during their westward march. This disease is transmitted from one animal to another by ticks, mites, lice, and other parasites and takes a heavy toll of both the wandering horde and those remaining on the mountain heights. As the malady is infectious and their dead bodies and dung defile wells and other sources of drinking water, epidemics of "lemming fever" become a scourge to the population of regions through which they pass.

With every hand, fang and claw bent on their extermination, the lemming would long since have become extinct were it not that this animal leads all Norwegian rodents in fecundity. Because of this ability the thin ranks of those remaining on the heights are able to repopulate the home territory, and the cycle of migration again occurs.

While overproduction and the consequent density of population undoubtedly account for lemming migrations from the mountains of Norway, their determined march in a fixed direction, and their hopeless plunge into the sea at land's end, still carry an air of mystery to those who seek scientific answers.



Autumn Leaves

By PAULINE DILLINGHAM

The earth seems drugged, these mild autumnal days,
With loveliness. Soft clouds the hills enfold,
And amber sunshine falls on trees ablaze
With flame and scarlet, burgundy and gold.

Only the rustling leaves, by hundreds blown
Across the lawn, disdain mere quietude;
The thrilling joy of motion having known,
They wheel and spin in strange, heroic mood.

Discarded, doomed to moldy death so soon,
They yet no whit of their wild grace abate;
But dancing through the golden afternoon,
Move lightly towards life's universal fate.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south. Time given is Standard Time; add one hour for War Time.

A Century of Comets

By ISABEL M. LEWIS

IT WAS on February 28, 1843, that one of the most spectacular comets of all time suddenly appeared—in broad daylight and close to the sun—to the astonished gaze of countless observers in southern Europe, the United States and Mexico. Some hours later it was seen from the Pacific and India. It was not until some days later that it was to be seen in all its splendor from England and northern Europe. It had all the features of a typical great comet—a well-developed coma, or head, with a brilliant star-like nucleus, and a tail of extraordinary length and splendor. In fact, at its best, the tail of this comet attained a length of 200,000,000 miles and covered an arc in the heavens of more than forty degrees.

A passenger on the *Owen Glendower* off the Cape of Good Hope described the comet as "a short dagger-like object" close to the setting sun. At time

of discovery, it was one day past perihelion, through which it swept at the unbelievably great velocity of more than 340 miles a second. In about two hours it passed through an arc of more than 180 degrees of its orbit. So close did it come to the sun that only about 80,000 miles separated it from its surface at least distance. Its tremendous velocity alone carried it safely past and headed it toward aphelion. Although it has been journeying outward toward aphelion, or the most distant point in its orbit, a hundred years now, two centuries or more may elapse before it arrives there; for its period has been estimated reliably to be more than six hundred years. When most distant from the sun it will be crawling through space at a snail's pace compared with its tremendous velocity at perihelion.

One of the most remarkable features of this comet

was its long, straight, and narrow tail. In *The Story of a Soldier's Life*, General J. A. Ewart writes: "It was during our passage from the Cape of Good Hope to the Equator, and when not far from St. Helena, that we first came in sight of the great comet of 1843. In the first instance a small portion of the tail only was visible at right angles to the horizon; but night after night as we sailed it gradually became larger and larger, till at last up came the head, or nucleus, as I ought properly to call it. It was a grand and wonderful sight, for the comet now extended the extraordinary distance of one-third of the heavens, the nucleus being, perhaps, about the size of the planet Venus." This same observer was later to observe Donati's Great Comet of 1858, and he makes the following interesting comparison of the two comets: "A very large comet made its appearance about this time and continued for several weeks to be a magnificent object at night; it was, however, nothing to the one I had seen in the year 1843, when on the other side of the Equator."

The great comet of 1843 belongs to a group of "Sun Grazers." All travel in almost identically the same orbit but are scattered along it at intervals so far apart and so irregularly that their returns could not possibly be that of one comet. They may have been originally part of a primitive mass that broke up under the strain of a nearly grazing contact with the sun, when it would be subject to terrific gravitational force tending to disrupt it. Comets that are known to belong to the same group as the great comet of 1843 are the comets of 1668, 1880 (I), 1882 (III), known as the Great September Comet of 1882, and the comet of 1887. The "Eclipse Comet" of May 17, 1882, which appeared close to the sun on a photographic plate, was believed to be also a member of this same group.

The Great Comet of 1880 (I), called also the Great Southern Comet of 1880, has been described as the ghost of the comet of 1843. It was first seen on February 1 of that year by several persons in South Africa, South America, and Australia. It was not well placed for observation and disappeared after a few weeks. It resembled the comet of 1843 in that it had a long, narrow tail, but the nucleus was inconspicuous. It is believed that the nucleus of a comet consists of a mass of meteorites surrounded by gaseous matter and more or less loosely bound together by their mutual attraction. The size and number of these meteoric masses, and possibly also the nature of the surrounding gases, determine the brightness of the nucleus.

The Great Comet of 1882 surpassed even the comet of 1843 in splendor, and was one of the greatest

comets on record, comparable to the greatest of any century. Its discovery at Rio de Janeiro was announced on September 11, 1882. It had been observed even earlier, at Auckland on September 3, and at the Cape of Good Hope on September 8. On September 17 Dr. Common at Ealing, England, saw, independently, this great comet close to the sun and rapidly approaching it. At that time it was within a few hours of perihelion, at which time it was to transit the sun at a distance of less than 300,000 miles from its surface. Its silvery radiance contrasted strongly with the reddish-yellow of the sun's limb, and Dr. Common followed it "continuously right into the boiling of the limb"—the first time in history that such an

observation had ever been made. Its disappearance at transit was as sudden as if it had passed behind rather than across the surface of the sun. The fact that it disappeared completely from view when in front of the sun proved that even the nucleus, the densest part of the comet, was too small, and the remainder of the bulk of the comet

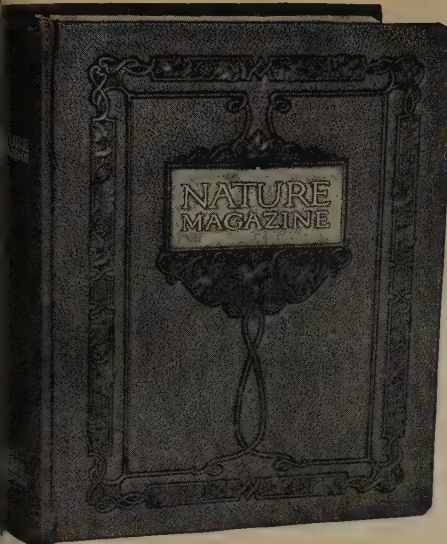
too flimsy, to be seen against the solar background.

On the following day it was only necessary to shade the eyes from the direct glare of the sun to see it in all its splendor next to the sun. All over the world that day, wherever the sun was visible, the dense white nucleus and sharply-defined tail were visible, and "the blazing star near the sun" was the one topic of conversation.

Unlike other great comets in the same group the tail was split and unsymmetrical, and the nucleus went through remarkable disruptive changes. At first it was nearly circular and a number of concentric envelopes were noticed surrounding the head, a characteristic of many comets, particularly Donati's Great Comet of 1858. In a few days it became elongated, then extended into a thin, luminous streak about 50,000 miles long. Upon this line appeared six or eight star-like knots. The largest and brightest was in the center and about 5000 miles long. This "string of pearls," as it was called, gradually extended itself to double its length and could be seen as long as the comet was visible—about nine months in all. Several observers also noticed shreds of cometary matter, like satellite comets, accompanying the main comet. Here was evidence of the actual disruption of a comet as it swung around the sun close to its surface.

The nineteenth century appears, more than any other, to have been a century of great comets. Every decade had its remarkable naked-eye comet. We can no more than name some of them here. In 1811 appeared the Vintage Comet, so named because it received the credit for the (Continued on page 444)





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Sabotage by Plow

Plowman's Folly. By Edward H. Faulkner. Norman, Oklahoma. 1943. The University of Oklahoma Press. 161 pages. \$2.00.

With millions of people garden and soil conscious, there could not be a better time for the appearance of this interesting and important book. How it will be received we would not wish to guess. That it will arouse vast argument in agricultural circles is, we hope, inevitable. We believe it will be fortunate. That we may expect such argument seems certain from the author's assertion that we have been grossly mis-using our soil by some of the accepted methods of farming, and "have been creating our own soil problems merely for the doubtful pleasure of solving them." And, for our part, Mr. Faulkner proves his case.

Space does not permit the exhaustive review that this book merits. Indeed, we are inclined to feel that the book must be read in its entirety in justice both to author and reader. Even a considerable review could well leave false impressions of the author's thesis, which nothing but the book itself can clarify.

We must, then, confine ourselves to the author's well-substantiated contention that the plow has been used in error; that we have ignored Nature's way of growing healthy crops; that we have refused to accept the proof of our own eyes and common sense. Mr. Faulkner writes as a trained agriculturist and against a background of experiment. More, he writes well, and this book is just as readable, valuable and stimulating to the layman as to the farmer. We cannot ignore a volume so significant as this—one that seeks to show "that our soil problems have been to a considerable extent psychological; that, except for our sabotage of Nature's design for growth, there is no soil problem."

Botanical Garden Trees

The roster of hardy trees and shrubs at the New York Botanical Garden now lists nearly three thousand species and varieties of woody plants. That they may be made more readily valuable to the visitor, a pocket-size catalog has been issued covering 302 genera from *Abelia* to *Zizyphus*, and providing a map showing the place of each of the listed trees or shrubs. The catalog sells for seventy-five cents.

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The School Page

By E. LAURENCE PALMER

Professor of Rural Education, Cornell University,
and Director of Nature Education, The American
Nature Association

FIBERS

THERE is good reason why our school geographies should emphasize the fact that we get much manila, sisal and hemp from the more remote regions of the earth. Since the areas that produced most of our fibers are now occupied by our enemies, it is more important that our schools provide children with experiences dealing with locally-grown substitute fibers. These experiences should include simple experiments to show tensile and other types of strength; to show varying effectiveness of twisting and weaving fibers; to provide, in general science, chemical tests that may be useful in identifying fibers and fiber substitutes. Other experiences should cover the processing of fibers from the raw material to the finished product.

Many teachers will be discouraged about undertaking this work because they can find in no book, for example, the color reaction that would be expected if the fibers of milkweed, dogbane, nettle, hemp or basswood were treated with iodine, sulphuric acid, ammonia or other substances. Alert teachers will welcome the opportunity to acquire their own information by using the various standard tests for identification of fibers in testing any local fiber that seems interesting.

Teachers who favor competition in school work will find few more profitable fields than in trying to match individuals and groups of individuals in the making of threads and ropes that will withstand the greatest pull; survive best the effects of weather, moisture and use; be produced with a minimum of effort and material; best meet demands of small size, flexibility, continued strain, and so on. The teacher who cannot quickly see the possibilities here should not be teaching. Here are a few results that might be represented in an exhibit showing work done in the schools in this field:

A cord at least one foot long and x inches in diameter that can support the greatest weight. The cord of the smallest diameter that can support for ten minutes a weight of x pounds. The cord of x diameter that will shrink the least when it becomes soaked, or dried. The cord of x diameter that will stretch the least when it becomes soaked, or dried. The cord of x diameter that may be used as a belt on a power tool and will continue service the longest doing a uniform amount of work. The cord that will remain most flexible under varying weather conditions. The cord that can be most quickly processed in an emergency to serve as a rope and the source of which is locally abundant.

Suggested Exhibits

An exhibit of the local plant and animal sources of fiber and cordage. An exhibit showing the processing of fishing leaders from local moth caterpillars, and including the best locally-produced tapered leader and the longest leader of x strength. An exhibit show-

ing the variation in the gut leaders that may be produced by the silk moths that live locally. An exhibit showing the culture and processing of locally-grown fiber plants in the production of fibers. An exhibit of weaving, spinning, twisting and otherwise making into fabrics locally-grown fibers. An exhibit of the skills possessed by Indians and other early residents who used bark, grass, sinew, roots and other substances in their arts and crafts.

A historical exhibit from skins through homespun to linen, silks, cotton and rayon based on examination of old newspaper files or museum records to show the local changes that have taken place in the production of cordage, textiles used locally, or, for that matter, used by civilized people as a whole. An exhibit of synthetic fibers produced by chemists and others, with explanations bearing on their production, use and probable future. An exhibit showing the varied used made of special fibers in the war effort to the end that rationing of some of these substances locally may be better understood.

These are only a few of the many activities associated with fibers that should present themselves to any teacher. Each one of these should provide a worthwhile "project" for some child, group of children, or class. Give the children the opportunity to make threads of plant and animal material, ash splints for baskets, willow withes for willow ware. Let them see how a spinning wheel works, how a primitive loom is set up and operated, how rope is twisted in the making by simple machines, how waterproof baskets are made of simple plant materials. Let them recognize some of the evidence of advancing cultures in the human race as enunciated by artifacts of different periods.

Local Sources of Supply

Let some child make a crude map of a limited local area indicating where suitable native fibers may be found in reasonable abundance; where local farmers are growing such fiber plants as hemp, cotton, flax or other species; the extent to which the local economy is dependent on the profitable production of fiber sources, and so on. Let some other child, or group of children, present the relative merits of growing fiber materials locally, and presenting the chief difficulties and advantages associated with the different species. As far as possible, all of these activities and presentations should be associated with the local situation as it bears on the national and worldwide situation.

Make some elementary studies on the prolonged use of fibers in textiles to the end that the strain on civilian production of fibers may be small, and to the end that clothing, furs and other things, either made of fibers or serving the same purpose as fibers, may continue their usefulness as long as possible. This will involve the care of clothing, of cloth-covered furniture, of rugs, and similar fiber products.

Make some study of the use of fibers as insulating material, in the packing of delicate instruments to be protected from jar in shipment. Look for the counterpart of this as seen in the nests of squirrels, mice, and some other mammals, and in the galls of many insects that provide food and shelter for the causal organism. Call attention not only to the heat insulating properties of compacted fibers but to the reduction in fire hazard of such materials since they do not normally burn well, if at all. The general science teacher may find plenty of interesting studies in following this lead.

The insert section in this number of Nature Maga-



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zine should provide rich reference material for the study of local and exotic fiber sources. Books on handicraft and woodcraft should provide further guidance, if this is needed.

We have emphasized food and machines in directing our war effort. Should the struggle be prolonged, it will not be long before intensified rationing of fiber materials will be in order. Many have complained that the rationing of foods, rubber, gasoline and other substances was established too suddenly; that people did not have ample warning so that they might, to the best of their ability, hoard, feather their nests, or voluntarily learn to adjust themselves to restricted supplies. It would seem that with the lessons of the rationing of these substances before us, the wise person and the wise teacher will begin now to lay an intelligent basis for facing inevitable restrictions in the use of fibers. Hoarding is neither patriotic nor necessary. Wise use of the supplies we now have, or can continue to produce, should so lessen the burden of production on the normal sources of fibers that rationing might conceivably be indefinitely postponed.

Much of the burden of adjustment to new use of fibers will fall on the civilian population. Our armed forces will need fibers for clothing, parachutes and for many other purposes, and they will get what they need. Children notoriously abuse their clothing in their normal outdoor lives and in so doing are not carrying out their patriotic duty. If teachers could show them how the care of clothing would help in the war effort, there is no doubt that most of them would willingly do their part. Here is an opportunity. What do you in the schools propose to do about it?

More Johnsonia

The eighth and ninth numbers of *Johnsonia*, Harvard University's Museum of Comparative Zoology's cumulative shell publication deal respectively with "The Genera *Xenophora* and *Tugurium* in the Western Atlantic," and "The Genera *Cypræacassis*, *Morum*, *Sconsia* and *Dalium* in the Western Atlantic." W. J. Clench is co-author of each, in the first instance with C. G. Aguayo and in the second with R. T. Abbott. Through these, sixteen more pages are added to the bulk of *Johnsonia*, which is available to shell enthusiasts on a subscription basis.

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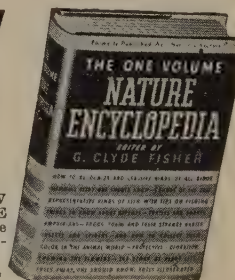
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NATURE IN PRINT

As a convenience to readers the books reviewed in the pages of Nature Magazine may be ordered through the book department of the American Nature Association, 1214 16th St., Washington 6, D. C.

(Continued from page 426)

the moon upon tides, to those of the shape of bees' cells, the movements of birds and fishes, the structure of the eye and the growth of the foetus in the womb." Its novelty, Dr. Raven says, "consists in the fact that in it Ray turns from the preliminary task of identifying, describing and classifying to that of interpreting the significance of physical and physiological processes, studying the problems of form and function and of adaptation to environment, and observing behaviour and recording the achievements of instinct."

These words are convincing of the valid interest we may have in John Ray and his works, and the value of Dr. Raven's biography is implicit in the fact that for many of us it is the only means available for realizing this interest.

How close are John Ray's interests in Life to our own, although more than two centuries separate us, may be suggested by the aptness with which these words—written recently by a professor of divinity in Cambridge, England, regarding a book by his Seventeenth Century "colleague"—might be used to describe the valedictory volume just published by a professor of psychobiology at Yale University who has devoted his mind and energies to laboratory studies of chimpanzees. There are on first thought no associations of John Ray analyzing *The Wisdom of God Manifested in the Works of Creation* and Dr. Robert M. Yerkes writing *Chimpanzees: A Laboratory Colony*. Yet who on second thought would deny that Ray would be one of Dr. Yerkes's most interested readers? Perhaps, indeed, the two authors' books have lineal relationships in literature, for Dr. Raven calls Ray's volume "the ancestor of the *Origin of Species*" and, although Dr. Yerkes points out that it is a misunderstanding to consider his work as an attempt to support "Darwinism," its rela-

tion to the Darwin-aroused interest in primates is obvious. Certainly the study of psychobiology with the chimpanzee as the "servant of science," as Dr. Yerkes describes this primate, is one of the farthest advances yet made on the same line that Ray was following when he changed from the "old world of superstition" to biology.

There is, of course, no dependence of Dr. Yerkes's volume on such relationships for its interest. A mere glance at its excellent illustrations should insure its departure from the bookseller, and the descriptions of the animals' behavior in Dr. Yerkes's monumental laboratory will intrigue most readers on into the night. Even the directions for handling and caring for chimpanzees are intensely interesting, including, incidentally, the admonition: "Out-of-door existence . . . has the incomparable advantage of making a continuous demand on the animal's physiological adaptability." Yet despite the vividness of these interests, the most enduring interest in this volume, as in that by Dr. Raven, is the excitement of the idea that has influenced the author. It is the idea implicit in Dr. Yerkes's phrase for the chimpanzee—"servant of science."

"If as servant of science the chimpanzee," he writes, "should help to make clearer and more attractive to mankind the achievement of greater social-mindedness, dependability, and cooperativeness, how immeasurable our debt to it! The really important things for us at present are recognition and active acceptance of the principles of modifiability, controllability, and consequent improvability, of human nature."

These are the things Dr. Yerkes perceives as important after studying the chimpanzee for more than a quarter of a century—not as an animal organism alone but primarily as a subject for use in the solution of basic problems in psychobiology. This was the study that Dr. Yerkes first thought of in what he calls a daydream, later planned for, then saw realized in a program with some of the most imposing sponsorships known to science, and now describes in his "story of an idea." It is a study more interesting even than chimpanzees, and especially so to those who have followed the story of modern science from its beginnings. It is the more inspiring when Dr. Yerkes writes, "What has been accomplished is trivial by comparison with what waits to be done."

Committing his responsibility to

those who will continue his work, this pioneer of our own time says, "There is increasingly urgent need for the broadening and deepening of knowledge of vital processes in preparation for the development of biological engineering and its eventual flowering in human engineering. Such preparation is of the utmost importance, for we can no more escape this wave of human progress than we can that of physical engineering. Our only safety lies in increase of knowledge and wisdom and of good will."

John Ray, Naturalist: His Life and Works. By Charles E. Raven, D. D. Cambridge: At the University Press. New York: The Macmillan Company. 1942. 502 pp., with frontispiece portrait, general index, index of flora, and index of fauna. \$7.

Chimpanzees: A Laboratory Colony. By Robert M. Yerkes. New Haven: Yale University Press. 1943. 321 pp., with 158 photographs on 63 plates, 24 text figures, bibliography, and index. \$5.

Early Naturalists

Early Naturalists in the Far West. By Roland H. Alden and John D. Ifft. San Francisco. 1943. California Academy of Sciences. 59 pages. Illustrated. \$1.00.

Douglas, Coulter, Steller, Bullock, Eschscholtz, Mertens—all these names have been perpetuated in the generic or specific names of flora or fauna of our West. These and many others came from Russia, England, France and elsewhere to study and collect. They came as surgeon-naturalists of one of the many expeditions sent out, usually for economic or geographical reasons, or as special scientific envoys of their countries. In this booklet, which is published as one of the occasional papers of the California Academy of Sciences, the story of these naturalists is briefly and interestingly told. The first naturalists of the West, and probably in all North America, were the Aztecs, who had made amazing progress. This was lost upon the Spanish, who came to conquer and not as scholars. Francisco Hernandez, indeed, was the only Spaniard who attempted to utilize the work of the Aztecs. From Russia came several expeditions, bringing such men as Steller; from England came Cook; from France the well-equipped but ill-fated La Pérouse voyage. A selected bibliography is supplied by the authors to aid one in exploring further.

The 5-C Club

After careful preparation and local organizational experimentation, there has been launched in Phoenix, Arizona, a program that, we hope, will spread to all corners of America, and to foreign lands when the world returns to its senses. This is the launching of the 5-C Clubs. It is not really the launching since the program has been tried out for three years as an extra-curricular activity of the Phoenix Union High School, and has proved its worth.

The 5-C Club has five social objectives to be achieved through study of and acquaintance with Nature. These are the enhanced development of Character; the increased understanding of the obligations and privileges of Citizenship; the more effective indoctrination of a spirit of voluntary Conservation; the more joyful appreciation of God's Country; the wider expansion of moral, intellectual and esthetic Culture.

This is an entirely non-profit plan. Its only way is to finance itself by charging small amounts for pamphlets, charters and membership cards, so that the Mother Club at the Phoenix High School can continue to print and distribute its literature. All funds are handled by the school's bookkeeping department.

Space here does not permit an adequate description of the objectives and plans for the 5-C Clubs. These are thoroughly covered in a bulletin—printed at Phoenix Union High School—that includes the plan of organization and other essential details. Credit for the idea and the drive to put it into effect goes to Roy M. Langdon, founder and faculty sponsor of the local club. With the cooperation of the club members and a distinguished list of patrons, three years have been devoted to maturing the program so that it could be offered for adoption elsewhere. That point now has been reached.

This notice of the 5-C Clubs can only be introductory. For further details teachers and students should write to Roy M. Langdon, Phoenix Union High School, Phoenix, Arizona.

Abounding Miracles

When we first reviewed *How Miracles Abound* by Bertha Stevens in 1941, we actively recommended it as a Nature book of outstanding worth. It is now our pleasure equally to recommend an interesting and valuable adapta-

tion from the book under the editorship of Sophia L. Fahs, with the collaboration of Dorothy Irma Cooke and Jeanette Perkins Brown. This is in the form of two series of eighteen leaflets designed for use by Sunday School teachers and parents in the teaching of a Sunday School course that has been well called "God's Wonder World." As the editor points out: "There is really nothing new about approaching a study of religion through seeking to find God in this everyday world. Jesus found hints about God in many near-by things—in the beauty of the lilies, in the tragedy of a sparrow's death, and in the impartiality of the sunshine."

Thus, to supply the text of these leaflets, the material has been simplified into little four-page illustrated leaflets that provide adequate basis for discussion and just enough stimulation of interest to set the student on the trail of more information. An excellent guide for teachers accompanies the sets of leaflets. This guide offers a wealth of suggestion for further development of the leaflet ideas, and provides additional reference material. We should say that this Sunday School Nature course would serve youngsters from seven to ten and, assuming that we can remember back that far, we should say that had some such lively and interesting Sunday School lessons been supplied us at that time our enthusiasm for that part of our Sunday would have been much greater than it was.

The leaflets and the teacher's guide are all published by The Beacon Press, Boston, Massachusetts, at 75 cents a set.

Grasshoppers et al.

The Grasshopper Book. By Wilfrid S. Bronson. New York. 1943. Harcourt, Brace and Company. 128 pages. Illustrated by the Author. \$1.75.

With the publication of this excellent book for young people, Mr. Bronson's list of Nature books now becomes a sextet. As in the earlier books, the author's text is at once interesting, entertaining and informative. His illustrations add a great deal to the value of the book. Four chapters are devoted to the grasshoppers, their machinery, growth, economic significance and various species. Then chapters are given over to their close relatives, which include the katydids, crickets, walkingsticks, mantises, and, whether you like it or not, the roaches. It is a worthy book.

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THE MYSTERIOUS EEL

(Continued from page 416)

A slight anatomical difference distinguishes the European from the American eel, and, so far as is known, no European eel has ever been found in American waters, nor has an American eel been found in European waters. Although both varieties are spawned in the same section of the ocean, they appear never to have crossed.

The young eels are very tiny when they begin the long trip to the rivers, ponds and lakes that were the homes of their ancestors. Their number must be millions, for, even after depletion as food for larger fish, they enter the estuaries of the tidal rivers of England in such vast quantities that it was formerly the custom to hold eel fairs, when people caught the eels in fine sieves and cooked them in loaves, regarding them as a great delicacy.

One day in Canada I witnessed a migration of young eels. I was trout fishing in one of the small rivers in Nova Scotia and reached a waterfall where the rocks were overgrown with short moss. A curious stirring in the moss attracted my notice, and investigation disclosed thousands of little eels about an inch and a half long, and about as thick as the lead in a pencil, leaving the water at the foot of the fall, climbing up the wet moss on the face of the rocks, and entering the water again at the top. That climbing to high elevations does not worry eels is evidenced by the fact that they are plentiful in the mountain lakes of Switzerland, several thousand feet above sea level.

The natural end of the eel's life-span is as mysterious as is its beginning. Concerning the more familiar end of eels I can, perhaps, do no better than to pass on the advice given by Thomas Ingoldsby:

* * * "Crede experto—trust one who has tried—

Have them spitchock'd—or stewed—they're too oily when fried!"

A CENTURY OF COMETS

(Continued from page 438)

excellent vintage of wine in western Europe that year. Comet wine it was called and sold for many years as such. The Great Comet of 1825 was noted for its five tails. It is probable that De Cheseaux's

comet of 1744 holds the record with six. Halley's famous comet returned in 1835 and lived up to its reputation for greatness. Another great comet of the nineteenth century was the comet of 1861, remarkable for the fact that the earth passed through its tail, and at that time, an effect of perspective, it had a fan-shaped tail. This comet also was plainly visible in broad daylight. A remarkable feature also was the appearance of eleven separate envelopes seen to spring from its head at regular intervals, a new one rising and dispersing every second day. In the minds of the superstitious the appearance of this comet was associated with the outbreak of the Civil War.

It is an interesting fact that up to the present time the only apparition of a comet in this century that may be considered in any sense *great* is that of Halley's comet, which returned in May, 1910. Aside from that, this century has been remarkable for its dearth of bright comets. How to explain away two world wars and no great comet is a problem for those who see a connection between these apparitions and great human events.

Venus is now a brilliant morning star reaching greatest brilliancy on October 13. Mercury is low in the East at sunrise, rising an hour and a half before the sun on October 10. Jupiter is now in the morning sky, and at moonrise on October 23 an occultation of the planet by the moon will be ending. Mars now rises about two or three hours after sunset in Taurus, a little to the northeast of Aldebaran. Saturn is also in Taurus at this time and rises about one-half hour after Mars.

WAR GAS NUMBER ONE

(Continued from page 410)

guisher, and inventors all over the world have developed all sorts of improvements upon his idea, from heat-activated robot sentinels of modern war plants to the huge chemical engines of city fire departments. So widely has CO₂ been used in fire prevention and fire-extinguishing devices connected in so many ways with the war effort that someone has called carbon dioxide "the watch-dog of safety" for our Army, Navy, Merchant Marine, and for war industry in general.

Carbon dioxide will put out almost any sort of fire save a magnesium incendiary—whose vicious

heat actually wrests the oxygen from its firm bonding to the carbon. There are wide variations, however, among flammable substances, and human ingenuity has been prolific in devices to deliver carbon dioxide when and where needed, in a hurry.

In many fire extinguishers, the gas is released by chemical action; the liquid that squirts out of the old-time overturned copper-cylinder-with-a-hose bears carbon dioxide generated by mingling acid with bicarbonate of soda. Among the hardest fires to handle are flames of volatile and explosive liquids—gasoline, alcohol, and others widely used in modern chemical industry but with which the public is less familiar. For these, foam types of extinguishers have been devised. Carbon dioxide is released in a lather of tiny bubbles, which flows over the flaming surface, smothering the fire by blanketing out the oxygen needed for the burning even of aviation gasoline. One widely-used product derives the viscosity of its bubble-film from licorice residues, which are themselves more largely a by-product of tobacco flavorings than from the familiar black and rubbery "lickrish candy." A more recent foam-releasing powder has been developed because of the huge employment of alcohol, acetone, and ether in making explosives, synthetic rubber and other war munitions.

In other extinguishing systems, compressed carbon dioxide stands guard in cylinders or other suitable containers, to be released manually, or often automatically, through increasing heat of combustion. Devices of this sort quell fires of sabotage or battle on shipboard.

Aviation's most destructive enemy is fire. In airplanes carbon dioxide releasers snuff out accidental or battle-caused blazes that otherwise would soon end plane, if not the pilot and crew—especially in plywood craft. In time of battle, empty space in gasoline tanks is filled with carbon dioxide rather than air, to the bafflement of incendiary bullets. When a plane crashes in a training field or airport, carbon dioxide trucks speedily extinguish the flame. A blizzard of carbon dioxide snow cools hot surfaces while rescuers pull them apart to look for crewmen who have not had time to parachute. Not the least of carbon dioxide's values lie in its gaseous ability to expand from liquid storage in truck and tank, spreading into cavities and crevices and cran- nies to flood out flame-encouraging

oxygen. Also, when used as snow or gas there is no watery mess left to damage unburned materials and to clean up afterward.

For fires of electrical origin, or where there is electric apparatus, carbon dioxide is effective and it lacks the conduction dangers of water. In giant hydro-electric plants, such as those at Grand Coulee, Bonneville, and Boulder Dam, carbon dioxide is a sentinel against accident and sabotage.

There are still other values in the quick expansion of compressed carbon dioxide. As "choke damp," subterranean pockets of naturally formed CO₂ were a danger of old time mining, now considerably minimized by detecting devices and ventilating systems. In modern coal mines, in fact, CO₂ promotes safety rather than affords hazard. Given a chance, the liquefied gas will expand to 450 times its former volume. It will do it in a hurry, yet without the splintering violence of gunpowder or nitroglycerine. Released from an ingeniously devised cartridge, it thus breaks up coal veins with a minimum of shattering, and without development of noxious fumes. An adaptation of this cartridge blows troublesome slag from open hearth furnaces of the steel industry and from rotary kilns. In a smaller-scale explosive use, Army rifles fire carbon dioxide-impelled slugs for short range practice, saving gunpowder and scarce brass shells.

Most publicized of purely expansive uses have centered about the rubber-raft adventures of Dixon, Rickenbacker, and others. Rafts carried in airplanes are inflated by shatterproof steel "magic bottles" no larger than a milk bottle, and newer models fill themselves automatically as soon as they hit the water. When the paper on which the story of Dixon, Aldrich and Pastula was published still grew in North American forests, German troops were swarming across the rivers of Poland and Yugoslavia in rubber boats which carbon dioxide made buoyant. Even large pontoons for floating bridges use carbon dioxide. When planes hit the water they tend to sink so quickly that the crew must work fast to get clear. Nowadays, carbon dioxide flotation bags or "airplane water wings" pop out when planes so equipped come down at sea or miss the deck of a carrier.

As for the rafts themselves, the most modern devices would look like luxury liners to men who in past months have drifted at sea. They contain sails to catch the

wind, radio sets to summon help. Fishing tackle comes from handy pockets. There are even gadgets and chemicals to make salt water drinkable. And good old CO₂ keeps the whole business afloat.

One-man boats have been devised for parachutists who face a water hazard. Smaller devices that save our aviators and our sailors include life belts that replace the old cork ring, and life saving suits that hold the wearer erect in the water, while big brightly-colored inflated hands* make it easier for him to signal a plane still in the air or thumb a ride from a passing destroyer.

While the war lasts, multitudes of men of all nations will owe their lives to carbon dioxide. It is safe to say that no American fighter will miss all of its unknown and less dramatic benefits. Even so, American fighters and civilians both will be glad enough when the day returns when carbon dioxide concerns them chiefly in bubbles of soda pop and in dry-packing for Sunday's ice cream.

Paper Panties



On lamb chops are out for the duration. We can take our lamb chops in the nude and let the Army and Navy have the paper. Waste won't win. Paper is critical. Paper is needed to make cartridge plugs, for shipping containers for food and medicine, to protect parachutes. There are thousands of military uses for paper.

Our Army and Navy need thousands of tons of paper to help win this war. One hundred and thirty million Americans conserving the use of paper in stores, shops, service establishments and in other ways can do the job. Cooperation conserves. This magazine has found ways of conserving ten per cent of the amount of paper it used in 1942. How much can you conserve?

Magical Wood

As the third of a fine group of booklets, the American Forest Products Industries, 1319 18th Street, N.W., Washington, D. C., has recently brought out *New Magic in Wood*. It covers the new industrial applications of wood that have resulted from intensified wartime research. This 36-page booklet is planned for use in school work in grades between the fifth and ninth. It is available free.



This man was taught not to drink water

Drinking water is scarce in North Africa.

So before our soldiers landed there, they were weaned away from water. A dash of iodine in their drinking water served the double purpose of disinfecting it, and making it taste awful. By the time the boys landed in Africa, they'd lost all taste for water.

The favorite prepared drink is lemonade. Field Ration K provides it—along with veal, pork, sausage, coffee, bouillon, malted milk tablets, biscuits, chocolate and chewing gum—all in a 33-ounce pack. Sounds like somebody was taking pretty good care of our boys, doesn't it? And that's right. American soldiers are the best-fed, best-equipped, best-cared-for in the world.

But keeping them that way takes money. So much money that Uncle Sam asks us to invest not 10% or 15% or 20%, *but all we can in War Bonds*. Chances are, you're already in the Payroll Savings Plan—doing your bit. But don't stop there. Raise your sights! Do your *best*! Remember, you get back \$4 for every \$3 you invest, when Bonds are held to maturity. But your money is needed *NOW*!



**YOU'VE DONE YOUR BIT..
NOW DO YOUR BEST!**

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Under the Microscope

By JULIAN D. CORRINGTON

VISCERAL MUSCLE

In the course of development of the body of higher animals, three kinds of muscular tissue have been specialized; visceral, cardiac, and skeletal. These three together form one of the five main kinds of tissues—epithelial (this Department, Feb., 1943), connective, muscular, nervous, and vascular (blood, April, 1940)—and comprise a chapter in the important microscopical science of Histology, the study of tissues and organs.

Visceral muscle is so-called because it constitutes the muscular coats of the visceral organs, those occupying the abdominal cavity, such as stomach and intestine. Several other names have been used by various authors, however: smooth muscle or non-striated or non-striped or plain muscle, since the fibers are not cross-striated with fine lines as is the case with the other two types; involuntary muscle, as the action is not under control by the voluntary nerves; and hollow muscle (a poor term), indicating that the fibers line hollow tubes and not that they are themselves hollow.

This type of muscle exists in the form of discrete cells, whereas the other two are cell aggregates. In development, all but a few of the visceral muscles come from mesoderm, and from that embryonic form of connective tissue termed mesenchyme. This tissue is a filler-in of the forming body and gives rise to adult connective tissues of all sorts, both visceral and cardiac muscle and, either directly or indirectly according to differing opinions, all of the vascular tissues, including the endothelium of vessels as well as the blood corpuscles.

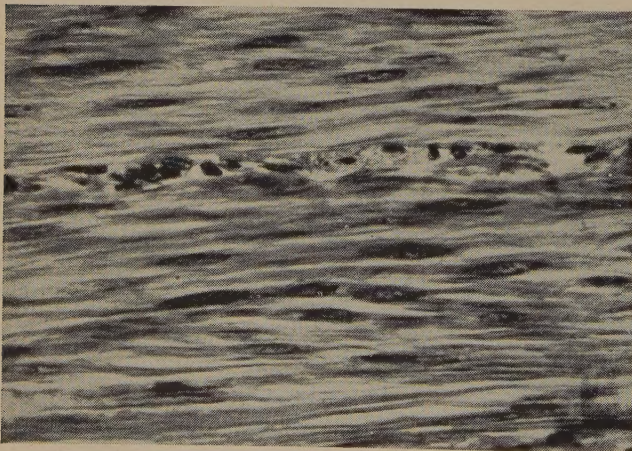
Mesenchyme cells are stellate (star-shaped), the cytoplasm streaming away into tapered processes in several directions, and apparently continuous with similar processes from neighboring cells, making the whole a network of loosely arranged cells with no definite cell walls between (syncytium). In becoming visceral muscle cells, these mesenchymal units change

in shape from stellate to elongate, the nuclei also lengthening. They mass together into layers and are generally regarded as losing their connections with one another. Each cell is then a separate entity, termed a fiber, and, after appropriate treatment, can be isolated from its fellows, when it is seen to be a very elongate structure, tapering from the middle toward both ends.

As development proceeds, each muscle fiber shows a differentiation of the cytoplasm within the delicate cell wall into a series of very fine longitudinal myofibrillae (muscle fibrils), running parallel to each other and diverging to pass around the rod-like nucleus. Between these fibrils is an exceedingly fine-grained cytoplasm, best seen at either end of the nucleus, where the diverging fibrils leave a small conical space of non-fibrillated protoplasm. The fibrils are supposed to be the contractile substance, although this view has been challenged repeatedly and many authorities regard them as artificial appearances, not present as such in living cells.

Visceral muscle in the adult generally occurs in the form of two sheets, an inner circular and an outer longitudinal, making up the bulk of the wall of tubular structures, including the digestive tract, trachea, urogenital ducts, and blood vessels. Favorite organs for sectioning include the small intestine, bladder, and uterus, while the first two of these have been most widely used for isolation preparations. In a cross section of these organs, the inner circular layer will be cut lengthways of the fibers, while the outer longitudinal layer will appear in cross section.

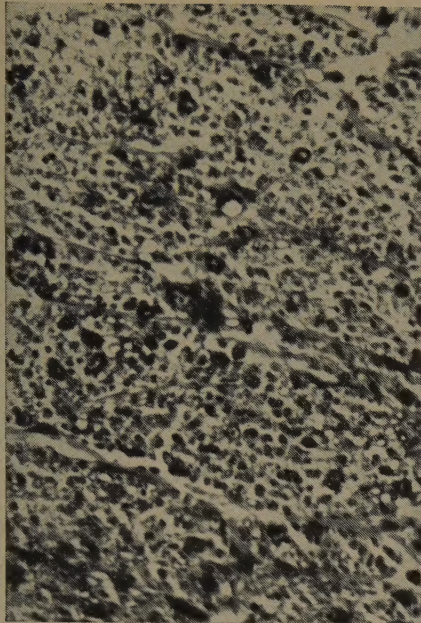
Viewed longitudinally, the fibers interdigitate in a felt-like sheet so that outlines of individual cells are difficult to follow. Often one fiber is too long to be included in a single view, or, since these are flexible, wavy, or curved, the entire extent of a fiber may not lie in the plane of the section and a portion may be sliced away. In cross section, the fibers may be cut through the nucleus, or, far more frequently, through a tapered fiber beyond the nucleus; hence many diameters from large to very small will be presented. The outlines are rounded or polygonal, the nucleus round. In a cross section of the small intestine of a cat or other commonly employed laboratory mammal, the inner circular layer is much broader than the outer longitudinal one. Together they constitute the tunica muscularis and are responsible for the waves of peristaltic contraction that keep food moving along the tract. These muscle cells are supplied by fine capillaries and innervated by very small fibers of the sympha-



Visceral muscle in l.s.



Isolated visceral muscle fibers



Cross section of visceral muscle

thetic nervous system, with ganglion cells and plexuses of nerves ramifying throughout the narrow space between the two layers.

A routine cross section of the intestine stained with Delafield's hematoxylin and eosin serves as well as any for a general study, though nuclear details are brought out more fully by using iron hematoxylin, followed by orange G as a counterstain. Isolated fibers can be prepared most easily by macerating a small piece of frog urinary bladder in 20% nitric acid for 24 hours, washing thoroughly in several changes of water, shaking and teasing the fibers apart, then dehydrating to 95% alcohol, staining in eosin, fast green, or Lyons blue, completing the dehydration, clearing, and mounting in balsam. Small shell vials are excellent objects in which to carry on all of these operations prior to mounting. Before adding the cover glass see that the fibers are well distributed and not overlapping or bunched.

BEGINNER'S PRIMER

In the realm of insects, greatest interest for the student, collector, or economic entomologist lies in the five principal orders that make up the bulk of the subclass Holometabola, the insects that undergo a complete metamorphosis. These tremendous assemblages are the Coleoptera or beetles; Lepidoptera, or butterflies and moths; Diptera, or flies; Siphonaptera, or fleas; Hymenoptera, or bees, wasps, and ants.

Here we have a group of an-

imals, most numerous of all creatures on the face of the earth and consequently, in spite of their small size, eminently successful in their struggle for survival, that go about the business of life in a most unique manner. The two great functions of all organisms, plant or animal, are to survive and to reproduce. To survive, one of the main jobs is to eat, and most animals must do this constantly, devouring enough food in their young stages so as to grow rapidly to their mature size, and thereafter a proportionately smaller quantity in order to maintain their weight and strength. As adults, they must both eat and reproduce. The first task, eating, concerns solely the survival of the individual; reproduction has nothing to do with the individual, but deals only with survival of the race. So basic is the distinction between these two duties that biologists speak of somatic (body, i.e., individual) and germinal (reproductive) cells or tissues or functions, and philosophers ponder the rôles and significance of soma and germ.

In holometabolous insects these two tasks are divided between two sharply differentiated stages in the life cycle, in which the individuals concerned are utterly unlike. Without instruction to the contrary, no one could ever imagine that caterpillar and butterfly were the same animal. The caterpillar, a larva, is wormlike and more or less uniformly segmented, without obvious distinctions into body regions, while head, thorax, and abdomen are very evident in the butterfly (imago or adult). The larva has three pairs of jointed legs, very short and stubby, on the thorax, then a series of fleshy projections called prolegs to hold up the abdomen; the imago has three pairs of long, slender legs and no prolegs. The caterpillar has no wings and has chewing mouthparts; the butterfly is winged and has sucking mouthparts; their patterns and coloration are generally entirely different; the one is terrestrial and arboreal, the other aerial. And so it goes through a long list of differences. The business of the caterpillar is eating and growing through a relatively long period; that of the adult, which grows not at all, is eating only enough to sustain life for a short time, meanwhile flying about so as to meet an individual of the opposite sex, to mate and, for the female, to lay fertilized eggs on a suitable food plant so that larvae of the next generation may eat. Flight also aids dispersal. The larva eats until

References for the Microscopist

For the past several months we have suggested in this column a number of basic books as providing background for work with the microscope. With this issue we are taking the next step and listing our recommendations in six additional fields. In so far as the subjects interest you, buy one of these each month, or as often as you can. They make excellent gifts for others, or as suggestions for those who will wish to remember your birthday.

ALGAE

- Fresh-water Algae of the United States**, by G. M. Smith. The outstanding complete manual, with descriptions, full accounts, ecology, and collecting\$6.00
- Algae, the Grass of Many Waters**, by L. H. Tiffany. An account of this group that will interest all microscopists\$3.50

BACTERIOLOGY

- Fundamentals of Bacteriology**, by M. Frobisher. A very complete account of all groups and methods....\$4.00
- General Bacteriology**, by D. B. Swingle. Briefer treatment than the preceding; very well written and illustrated\$3.00

OPTICS

- Optics and Service Instruments**, anonymous. Very good elementary treatment, optical principles and instruments\$1.75
- Introduction to Physiological Optics**, by J. P. C. Southall. Advanced text on the physiology of vision...\$5.50

PROTOZOOLOGY

- Protozoology**, by R. R. Kudo. Comprehensive, illustrated manual of all groups; indispensable\$6.50
- Biology of the Protozoa**, by G. N. Calkins. Standard text and reference for the group; not for identification. \$7.50

TEXTILES

- Textiles and the Microscope**, by E. R. Schwarz. Concise and comprehensive manual on use of microscope in analyzing textiles\$4.00
- Textile Fibers: Their Physical, Microscopical, and Chemical Properties**, by J. M. Matthews. One of the standard texts and references on this subject\$10.00

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its exoskeletal armor can contain no more, then molts, grows rapidly before the new skin and exoskeleton can harden, and so on through a series of larval stages termed instars, each of which is distinctly larger than the preceding. The adult does not molt or grow.

Life cycle stages in a holometabolous insect are egg, larva, pupa, and imago. The pupal stage is generally a quiescent one, often passed within a pupal case, as a cocoon. During this period the larval structures are torn down and adult systems reconstructed along the new plan. Finally the pupal skin splits and out comes the winged imago. Such a transformation has excited the wonderment of mankind for ages, and has been the source of numberless mythological, poetic, and dramatic allusions and metaphors. The preceding account draws attention to the broad evolutionary implications of this complex life history and neglects all of the enticing literary possibilities.

In our next chapter we shall begin the discussion of the largest of all insect orders, the Coleoptera.

APPLE POLISHER

One of the most recurrent problems in the teaching laboratory, as well as with the individual working alone, is that of obtaining sufficiently *low* magnification. The novice or person unacquainted at first hand with microscopes invariably supposes that the search is always for higher power, which is seldom the case. Very often student equipment is limited to a compound microscope with one ocular, probably 10X, and two objectives, 16 mm. and 4 mm., giving only two choices as to magnification, 100X and 430X. An instrument of this sort does very well for a majority of slides, including most sections, but is far from satisfactory in the examination of such objects as whole mounts of worms, insects, flowers, and embryos, or complete sections of intestine, kidney, and the like. Lest one fails to see the woods for the trees it is highly desirable that the student observe the whole object, or the object as a whole, first, before going on to details, or for drawing or photographic purposes.

Extra equipment will, of course, most ideally meet the situation, but requires an additional outlay not always possible to obtain. Best of all instruments for this group of purposes is the wide-field binocular microscope—a very expensive item. The wide-field tube, dissecting microscope, and many forms of simple microscopes and magnifiers in various kinds of stands come next.

Least expensive are additional elements for the laboratory compound microscope, and we wish to stress these since many users of the regulation instrument apparently do not know of them. First, as to objectives, there are the 32 mm. and 48 mm., with initial magnifications of 4X and 2X respectively. These can be screwed onto the nosepiece of any standard make and size of microscope and are much lower in price than are the higher powers.

Eyepieces of very low power are likewise obtainable. These are known as projection oculars, and in the catalogs of manufacturers must be sought under the list of items for microprojection rather than in the microscope section. The favorite power is 3X, though some firms make a 2X as well. The final magnification of any combination is found by multiplying the initial magnification of the objective with that of the eyepiece; hence with a 48 mm. objective (2X) and a 2X projection ocular, it is possible to secure as low a magnifying power as four with an ordinary laboratory microscope. A 3X projection eyepiece gives 6X when used with a 48 mm. objective, and 12X with a 32 mm. These powers are ideal for the objects

here considered. Most projection oculars have the eyelens separately movable so as to focus on the projection screen at any desired distance.

Many teachers know that the 16 mm. or regulation low power objective is separable and that when the front (lower) combination is unscrewed and removed, the remaining components form a 32 mm. objective. Microscope manufacturers seldom mention this point and may even advise against it, but the user can find no fault with the image thus obtained, and the only care needed is to keep the separated parts clean and avoid misplacing the front combination. The half-objective focuses at quite a higher level than when complete. With a 5X ocular, this procedure gives a final magnification of 20X and with a 3X projection eyepiece, 12X, and one of these two powers will be found ideal; a planarian, flea, or 48-hour chick embryo are easily contained within the field with plenty of room to spare.

Thus a sufficiently low power combination can be secured through the purchase of a single low-cost item, the projection eyepiece. If unobtainable under present wartime conditions, those interested can file away a memorandum on this apple polisher for future reference, meanwhile using the separated 16 mm. objective together with the lowest power of eyepiece available.

TRADE NOTES

Oldest and largest of strictly botanical supply houses in America is Triarch Botanical Products, at Ripon, Wisconsin. The proprietor is Dr. George H. Conant, who was connected for some time with the General Biological Supply House, Inc., in Chicago. In 1927 Dr. Conant started his own business in Philadelphia while serving as assistant professor of botany at the University of Pennsylvania. He moved to his home town of Ripon in 1929 and has since devoted his entire time to the supply business, serving all of the States and Territories as well as sixteen foreign countries. The Company deals in preserved plants, microscope slides, and lantern slides, including kodachromes; its trademark features three arches designated as accuracy, service, and dependability, and its slogan is "prepared by a botanist for botanists."

Dr. Conant has made a splendid offer especially for readers of this Department; half-price on everything except lantern slides and Kodachromes. Here is what to do: first send a three cent stamp to Julian D. Corrington, Nature Magazine, 1214 Sixteenth St., N.W., Washington 6, D. C., and request a copy of the Triarch catalog. When this arrives, select any items you wish and order direct from Triarch, remitting half of the list price for each item, only one of each to a customer, and mentioning that you are a reader of this Department in Nature Magazine (mention also A.S.A.M. if you are a member).

In addition to preserved plants and a wealth of expertly prepared microscope slides, Dr. Conant lists a booklet of beautiful photomicrographs consisting of 200 subjects on 64 pages at 75¢, and a set of 9 superb full color photomicrographic plates of quadruply stained sections, also for 75¢; but on this special offer will send both sets, one pair to a customer, for only 50¢. We can assure our readers that this is a truly remarkable bargain.

Anyone interested in microscopy may join our *American Society of Amateur Microscopists*; information and application blank sent on request. Teachers will find that Chapters of this Society function splendidly as science clubs; charter petition and Chapter Manual sent free on request by any member.